THE

POPULAR SCIENCE MONTHLY.

SEPTEMBER, 1889.

A STUDY FROM LIFE.

By OLIVE THORNE MILLER.

MANY a strange little beast from far-off quarters of the globe may be picked up in New York, in places where sailors are wont to dispose of their pets. In this way I came into possession of a rare and interesting animal, a black-headed lemur, or *Lemur brunneus*, native of Madagascar. He was a member of my household for nearly a year, and during that time the family circle was never dull. The whole of Barnum's menagerie next door could not afford more entertainment than did this one droll little fellow.

He was about the size of a small cat, or, to be exact, from the tip of his pointed nose to the root of the tail he measured sixteen inches; of that length, three inches were face and thirteen body and neck. His girth back of the fore-legs was nine inches.

The manners of the little stranger were extremely odd. His home was a cage in the parlor, where he was generally alone all day, and spent the time, it is to be supposed, in sleeping, although I must admit I rarely found him so. At about four in the afternoon I went into the room and let him out. The moment I appeared he came to the front of the cage, pressed his weird little black face with its clear topaz eyes to the wires, and then began to call and "weave" impatiently. The latter was a singular movement. Planting his hind-legs far apart in a half-sitting position, he held up and outward his short arms, and swayed his whole body from side to side—at each end of his swing bringing his hands down almost to the floor. This he did very rapidly, uttering every moment a short, quick sort of double grunt, with an occasional explosion or "snort," in the exact tone of a pig.

Of course, I instantly opened his door, from that time till ten o'clock being his regular daily outing. Like a flash he bounced

through it, jumped to the nearest chair, from that to the sofa, the table, somebody's lap or shoulder, the mantel, the top of his cage, or the piano, and so made the circuit of the two parlors, without touching the carpet. After thus going the grand rounds, he generally jumped to the floor, and ran all about under the furniture. His sharp nose nearly touched the carpet, and his back (owing to the four inches difference in length between his fore and hind limbs) sloped up at an angle of forty-five degrees to the tail, which stood straight up like a banner over his back, the tip sometimes curling forward like a dog's, sometimes backward like a hook. During the whole performance he constantly uttered a contented single grunt like "woof!"

If any movement in the room startled him, he broke into a grotesque gallop, bringing his feet up closely beside his hands at every leap. This gallop, which was rapid and light, always ended in a sudden spring to somebody's lap, or a scramble to the top of a tall easel, where he looked around to see what had frightened him. But if not disturbed, when his tour of inspection was over he usually went to the open fire, placed himself, sometimes on the toe of a lady's slipper if it were conveniently near, sometimes on a little three-by-five-inch cushion on the arm of an easy-chair. Here he sat up like a cat with tail hanging out before him, or fell eagerly to dressing his peculiar woolly fur, which stood out all over his body, washing his face by licking the outside edge of his hand and rubbing it back and forth over his face, and wiping his mouth on a chair as a bird wipes its bill, first one side and then the other. Especially did he labor over his eighteen-inch-long tail, scraping up the fur till it stood out round and gave that member great apparent size. The tool with which he accomplished so much was his curious row of lower front teeth, which ended in points of almost needle sharpness, and projected at an angle that prevented their being used to bite, but made an effective scraper for the skin, or a comb for his own gray wool.

Warmed and dressed, the playful fellow began his evening's amusement. If the master's quiet game of cribbage was going on, he often began by marking his prey from his seat on the chair-arm, and without warning springing to the middle of the table, scattering cards like chaff, upsetting cribbage-board and sending the pegs flying, slapping cards out of the hands of the players, and biting needle-like holes in them.

To make a great commotion of any sort was his delight. Sitting peacefully on my lap, or lying flat upon his stomach, every limb stretched out, apparently the most innocent and harmless of pets, he would often quietly rise to his feet and, before I suspected him, snatch my book out of my hand or spring over it into my face. If I started at this rough salute, as I was tolerably sure to

do, he was struck with panic, gave one mighty bound to the mantel, the bracket of a lamp, the edge of an open door, or the floor, where he stood a few seconds motionless as he alighted. A panic, indeed, struck through him instantly, with curious effect. Whether he were lying quietly on one's knee, standing, sitting, or in whatever position, on being alarmed by an attempt to capture him, or by an unexpected sound, he instantly disappeared—sideways, backward, or forward mattered not—without in any way making ready, or getting upon his legs. It was as if his body were a spring, or as if he were flung by some force outside of himself—he simply went. It is impossible to give an idea of this most remarkable movement; I never saw anything like it. A curious fashion he had also of leaping against the bare side wall of the room, which he struck flatly with all fours, and then bounded off in another direction. I have seen the same thing done by a squirrel, and also—strange as it seems—by a bird.

The extreme nervousness of the little lemur seemed to be caused by too much company. When alone with one person, especially if that one were my daughter or myself—his prime favorites—he was as quiet as the family cat. He sat or lay in the lap, and allowed himself to be brushed; indeed, he enjoyed brushing, and thrust out arms and legs to be operated upon. He sat up with his tail laid over his shoulders in a comical way, and, if he wanted to turn his head, he "ducked" it under the tail and brought it up the other side rather than change its comfortable position. This member was really an important charge to the little beast; he spent hours in dressing it, and by it he expressed all his emotions. When in quiet mood it hung straight down, as stiffly as if made of wood; on mischief bent, it assumed a wicked-looking sidewise turn, though still hanging; during his pranks and in excitement it stood up like a flag-staff, safely out of harm's way; if his "angry passions rose," it was swished, after the manner of a cat; and when he jumped, it delivered a severe blow, like a smart rap with a stick.

Never was a living creature more alert than this small brute. So acute was his hearing that it was absolutely impossible to surprise him. No matter how quietly and apparently off his guard he sat on a chair, one could not jerk or tip that piece of furniture so quickly as to take him unawares; at the first sign of movement he appeared on the other side of the room, one could hardly tell how. I wanted much to see him when he did not see me, and to that end several times stole into the room from the front. The back of the cage was toward that side, and he could not possibly see me. I took off my shoes, and moved—to my senses—without the slightest sound over the carpet; but when I reached the point where I could see the open front of his cage, there he was, waiting,

looking for me, his bright yellow eye pressed eagerly against the wires, in the corner nearest the side I came to. The instant he saw me he uttered a mocking grunt, which plainly said, "Thought you'd surprise me, eh?" and began a violent weaving and coaxing to get out. Perhaps he was thus wide awake because he seemed really to fear being alone, and to dread the dark. The moment he was left in the room the spirit of mischief departed, and he retreated to the top of his cage, where he remained till some one came in. The dusk, with its shadows, always alarmed him, and, when taken into a strange room, he cowered and clung to his friend as if frightened out of his wits. Fond as was the lemur of society, he was exceedingly nervous about it. When he heard a person coming through the hall, he first ran to the end of a sofa nearest the door; as the steps approached, he grew more and more uneasy; and, when the hand touched the door-knob, he yielded to wild panic, bounded to the other end of the sofa and over the back, where he held by one hand, while his body dangled behind. His great sensitiveness showed also in another way—he never met a human eye with his own. He saw every expression of the face, but he always looked just beyond it. He violently objected to being stared at, turned his head away, and, if his head were held between two hands for the purpose of looking in his face, he got away, either by a sudden spring to the top of the head of his captor or by wriggling himself out backward. His wool-covered body was the most elusive in the world to hold.

But, although the little fellow would not look one squarely in the face, he saw everything that happened, and was as inquisitive as any monkey. He liked to sit before the window and look at passers-by, both beast and human; a cat aroused him to the point of expressing his mind, and he saluted her by a short, sharp bark. A bugle that was brought out with the hope of curing him of too great familiarity with the person of the owner, proved, on the contrary, to be a special lure. He rose on his hind-legs—which he did with perfect ease—and thrust his nose into the large end, evidently to find the sound. Once happening to get possession of the instrument when its guardian was absent, the lemur made a thorough examination of it. He pulled it on to the floor, threw his body across it, embracing it with his legs to keep it in place, and then proceeded to push his head almost out of sight into the big end, take the small end in his mouth, as if to blow, and to make minute and careful study of every part of it, until fully satisfied that whatever he sought was beyond his reach, when he abandoned it.

The intelligence of the creature was notable. He knew his own blankets instantly wherever he saw them, and was quite positive that no one had a right to touch them; he learned his name read-

ily, always answered when spoken to, and came at a call like a dog, a thing very rare among animals of his sort. He also knew his own box, his chosen seats, his place before the fire, and insisted that they should not be used by others. In pictures he recognized a bird, or, at least, he tried to snatch it out of the paper, and the same with figures that looked like insects. He disapproved of change, complained when I closed the shutters, and looked askance at me when I put on a different dress. He knew with perfect certainty who would let him out of the cage and who would not; one of the gentlemen of the house might sit in the parlor all day, and, except for keeping an eye on him, the little beast made no sign; but let either of his mistresses enter, and he was excited at once, weaving, grunting, and demanding that the door be opened. He understood at once, too, when forbidden to do anything.

On the occasion of a several days' visit of a child, he was at first very jealous; did not like her occupying a lap he had considered his own, and opposed with a squealing grunt her sitting on his special stool before the fire. But she was a gentle child, and a little later he became very fond of her, let her pat him, sit beside him on his seat, and at last insisted upon lying on some article of her dress if any were in the room.

What the small African set his mind on he always secured in the end, for his persistence was simply marvelous. He was as fond of apples as any school-boy, and the head of the family liked to tantalize him by coming in with one hidden in his pocket. The sharp little nose sniffed it at once, and the eager little fellow sprang upon the apple-bearer, tried to dive into his pocket head first, then to dig into it from below, and, despairing of this, went to work to tear away the garments that covered it. No doubt he would have succeeded, but before he went so far the owner gave in, and delivered the fruit to the impatient creature. He snatched it at once, and fairly "gobbled" at it, biting off pieces with his back teeth, throwing his head up to chew them, and carefully separating and dropping the skin. He never at any time made a full meal, as do many beasts. His desire seemed to be merely to stop the cravings of hunger; the moment these were satisfied he opened his hand, and whatever food was in it dropped, he being apparently as unconscious as if he had nothing to do with it. He ate bread, sweet potato, and banana, and drank milk and water; but his delight was—with the girls—in candy, and that he never dropped. If there was a bit in sight, and he not sharing it, he was simply wild. A piece being offered, he snatched it, chewed it down, and instantly begged for more. The favorite trick of a mischievous youth was to give him a licorice-drop, which became soft and tenacious in the mouth, held his jaws together, and in every way was troublesome; but, in spite of his strug-

gles with it, he was never discouraged, and always coaxed for another.

No beast that I ever saw was more fond of play than the little Malagasy, not even a lively kitten. From the moment his door was opened till he was shut in for the night he often gave his mind to a constant succession of pranks. He scraped the beads off our dress-trimmings with his comb-like teeth, and he slapped or pulled books or work out of our hands, and especially liked to frolic in one's lap, lying on his back kicking with all fours, pretending to bite, and even turning somersaults or indulging in the most peculiar little leaps. In the latter he flung out his arms, dropped his head on one side in a bewitching way, turned half around in the air, and came down in the spot he started from, the whole performance so sudden, apparently so involuntary, and his face so grave all the time, it seemed as if a spring had gone off inside, with which his will had nothing to do.

A favorite plaything with the lemur was a window-shade. He began by jumping up to the fringe, seizing it and swinging back and forth. One day he learned by accident that he could "set it off," and then his extreme pleasure was to snatch at it with so much force as to start the spring, when he instantly let go and made one bound to the other side of the room, or to the mantel, where he sat, looking the picture of innocence, while the released shade sprang to the top and went over and over the rod. We could never prevent his carrying out this little programme, and we drew down one shade only to have him slyly set off another the next instant.

Next to the shade, his chosen play-ground was a small brass rod holding a bracket-lamp. It was not more than half an inch wide, and so sharp-edged that it seemed impossible that an animal of his size and weight could stay on it one minute, especially as it was not more than eight or ten inches long, and held a burning lamp at the end. The lamp was no objection to the always chilly little beast; he enjoyed the heat of it, and not only did he sit there with perfect ease, and dress his fur or eat his bread, but he played what seemed impossible pranks on it. He turned somersaults over it; he hung by one hand and swung; he jumped and seized it with hand or foot; whisked over it, and came up the other side. He never made a slip nor touched the lamp, and his long, stiff tail served as a balancing-pole.

Perhaps the greatest fun in our little captive's residence in a parlor was with a newspaper. The thing that inspired his first interest in the article was being told to let it alone, when he longed to tear it up. That ungratified desire made us constant trouble, till at last I resolved to give him his wish. I took an old paper and put it on the floor for him. His first pass was to come

with a big leap into the middle of it, when the rustle instantly scared him off in a second bound as tremendous as the first. He soon returned, however, and began again. He turned somersaults on it, rolled over on it, took hold of one corner and rolled himself up in it. But during all these performances, every fresh rustle of the paper put him in a panic, and he leaped spasmodically away—a wild frolic impossible to describe, with attitudes so grotesque, movements so unexpected, and terror and joy so closely united, that it was the funniest exhibition one can imagine. The next evening I arranged a newspaper tentwise on the floor. The lemur looked at it, contemplated the tempting passage-way under it, then dashed frantically through and flew to the highest retreat in the room, as if he had taken his life in his hands. He returned—for it was impossible to keep away—and resumed the gambols, the hand-springs, the various fantastic exercises, and between each two antics flung himself about the room as if he had gone mad, ending every romp by sitting a few seconds motionless, with a grave and solemn air, as if it were out of the question that he could be guilty of anything frivolous.

Unlike most beasts, this little fellow had a great liking for strangers, and frequently took violent fancies, in which case it was quite impossible to keep him away from the object of his affections. Some people liked it, but others did not; and when one young lady was actually afraid of him, he appreciated her attitude, and not only resented it by angry barking grunts, but contrived again and again to surprise her, by stealing up behind her chair and suddenly pouncing upon her. Of course, she shrieked, and he squealed and grunted and ran out his tongue at her. With his friends he was troublesomely affectionate, insisting on being held, on lap, arm, or shoulder, and following them from room to room, in a long, droll gallop on the floor, or by jumping from chair to table, and sometimes to their backs as they passed.

Almost every sound the creature uttered reminded one of a pig. Going about the room contentedly, he constantly made a low sound represented by "oof!" or "woof!" with the tone and accent of the animal mentioned; when anxious to get out of his cage, the grunt was double, like the drawing in and expulsion of the breath in the same tone, varied—as has been said—by a little explosive sound. His bark even was of a piggish quality. When angry or hurt, he delivered a squeal and grunt together impossible to characterize; and if rubbed and caressed, he breathed out a loud, rough purr. His cry of loneliness was truly piteous; I heard it occasionally through the register. It was a sobbing, dismal sound, sometimes half a howl, sometimes with a retching sound. In uttering this he opened a small round hole of a quarter-inch diameter in the front of his very flexible lips. If this cry is a

common indulgence of his tribe in the wilds of Madagascar, I do not wonder that the people are superstitious about them, and call them "ghosts" or "specters." No lament can be imagined more weird and torturing to the nerves. At first, when I heard my pet cry thus, I ran hastily down-stairs, thinking something dreadful had happened; but the instant his eye fell upon me, the rogue changed his wails into the grunt of recognition, and a demand to be let out.

When, after five hours of revels that kept his audience in shrieks of laughter or in terror for his life, the time came for him to go to bed, and his wire-gauze door was—in spite of his remonstrance—closed upon him, it was curious to see him prepare for night. His bed was in a round wooden box, fastened upon the side of his cage, lined and covered with blankets. Sometimes he lay on his back, his head hanging out upside down, and two legs sticking out at awkward angles; occasionally his arms were thrown over his head, and his hands clung to the edge of the box. But usually, after a long preparation of fur-dressing, he placed his head on the bottom of the box, face down, and then disposed his body around it, wriggling and twisting and turning, till he was satisfied, when he was seen lying on his side, his head not under him as would be expected, and his tail curled neatly around. Sometimes, after long and elaborate arrangement of himself, when one would not expect him to move before morning, he suddenly started up and came out as bright and lively as if he never dreamed of going to sleep. But more often, when he had thus composed himself, the heavy blanket was dropped before his door, the lights were turned out, and he was left for the night.

RECENT ECONOMIC CHANGES.

By Hon. DAVID A. WELLS.

THE readers of "The Popular Science Monthly" will remember the interesting series of papers communicated to its pages during the years 1887 and 1888 by Mr. David A. Wells; in which were traced out, and exhibited in something like regular order, the causes and extent of the wonderful industrial and social changes and accompanying disturbances which have especially characterized the last fifteen or twenty years of the world's history. It is safe to say that no economic papers have been published in recent years, on either side of the Atlantic, that attracted more attention or were read by so many persons with such interest and profit.

It affords us pleasure now to state that, since their original

publication in this journal, these papers have been in great part rewritten by the author, and in all revised and brought up to the latest date; and are now nearly ready for publication in book form by Messrs. D. Appleton & Co., under the title of "Recent Economic Changes, and their Effect on the Production and Distribution of Wealth and the Well-being of Society."

From advanced sheets we are enabled to lay before our readers the following illustrations of the quality of the new material that Mr. Wells has incorporated in his forthcoming volume.—EDITOR.

ON THE ORIGIN AND SEQUENCE OF TRUSTS.

It was formerly a general assumption that, when price no longer equaled the cost of production and a fair profit on capital, production would be restricted or suspended; that the less favored producers would be crowded out, and by the relief thus afforded to the market normal prices would be again restored. But this doctrine is no longer applicable to the modern methods of production. Those engaged in great industrial enterprises, whether they form joint-stock companies or are simply wealthy individuals, are invested with such economic powers that none of them can be easily pushed to the wall, inasmuch as they can continue to work under conditions that would not permit a small producer to exist. Examples are familiar of joint-stock companies that have made no profit and paid no dividends for years, and yet continue active operations. The shareholders are content if the plant is kept up and the working capital preserved intact, and, even when this is not done, they prefer to submit to assessments, or issue preference shares and take them up themselves rather than go into liquidation, with the chance of losing their whole capital. Another feature of such a condition of things is, that the war of competition in which such industrial enterprises are usually engaged is mainly carried on by a greater and greater extension of the market supply of their products. An illustration of this is afforded in the recent history of the production of copper. When in 1885 the United States produced and put on to the market seventy-four thousand tons, as against forty thousand tons in 1882, the world's prices of copper greatly declined. A large number of the smaller producers were compelled to suspend operations, or were entirely crushed; but the great Spanish and other important mines endeavored "to offset the diminution of profit on the unit of quantity" by increasing their production; and thus the price of copper continued to decline until it reached a lower figure than ever before known in history.

Under such circumstances *industrial over-production*—manifesting itself in excessive competition to effect sales, and a reduction of prices below the cost of production—may become chronic;

and there appears to be no other means of avoiding such results than that the great producers should come to some understanding among themselves as to the prices they will ask; which in turn naturally implies agreements as to the extent to which they will produce. Up to this point of procedure no exception on the part of society can well be taken. But such an agreement, once perfected and carried out, admits of an almost entire control of prices and the establishment of monopolies, in the management of which the rights of the public may be wholly ignored. Society has practically abandoned—and from the very necessity of the case has got to abandon, unless it proposes to war against progress and civilization—the prohibition of industrial concentrations and combinations. The world demands abundance of commodities, and demands them cheaply; and experience shows that it can have them only by the employment of great capital upon the most extensive scale. The problem, therefore, which society under this condition of affairs has presented to it for solution is a difficult one, and twofold in its nature. To the producer the question of importance is, How can competition be restricted to an extent sufficient to prevent its injurious excesses? To the consumer, How can combination be restricted so as to secure its advantages and at the same time curb its abuses?

Another cause of the so-called over-production is undoubtedly due to an agency which has never before in the history of the world been operative to the extent that it is at present. With the great increase of wealth that has followed the increased control over the forces of nature and their utilization for production and distribution, there has come a desire to convert this wealth into the form of negotiable securities paying dividends or interest with regularity, and on the recipiency of which the owner can live without personal exertion or risk of the principal. Hence a stimulus for the undertaking of new enterprises which can create and market such securities; and these enterprises, whether in the nature of new railroad, manufacturing, or mining corporations, once developed, must go on producing and selling their products or services with or without a profit in order to meet their obligations and command a share of previously existing trade. Production elsewhere, as a consequence, is interfered with, displaced, and in not a few cases, by reason of better conditions, permanently undersold. And the general result is appropriately recognized by the term "over-production."

Furthermore, in anticipation of such consequences, the tendency and the interest of every successful manufacturing combination are to put the prices of its products down to a figure where it will not pay for speculators to form new competitive stock companies to be bought off or crushed by it. For, if it did

keep up high profit-assuring prices, one of two things would eventually happen: either new factories would be started; or the inventive spirit of the age would devise cheaper methods of production, or some substitute for the product they furnished, and so ruin the first combination beyond the possibility of redemption. And hence we have here another permanent agency, antagonistic to the maintenance of high and remunerative prices.

CURIOUS CHANGES IN PRICES.

The record of extreme changes in prices, by reason of circumstances that are acknowledged to have been purely exceptional, is also most instructive, and removes not a few commodities from the domain of any controverted economic theory respecting monetary influences.

The price of manufactured Mediterranean coral—the trade in which is extensive—has been greatly depressed in recent years by reason of the discovery of new banks of coral on the coast of Sicily, from which the raw material has been obtained most cheaply, and in large excess of demand. The consequent decline in prices has, however, opened new markets in Africa, where the natives now purchase coral ornaments in place of beads of Venetian and German manufacture.

Few commodities have fluctuated more violently in price in recent years, or more strikingly illustrate the degree to which supply and demand predominate over all other agencies in determining price, than the vegetable product *hops*. In 1881 there was an almost universal crop failure, and the highest grade of English hops (East Kent) commanded 700*s*. per cwt. In 1886 the German Hop-Growers' Association estimated the quantity grown throughout the world at 93,340 tons, and the annual consumption at only 83,200 tons, so that there was an excess of production over consumption for that year of nearly 10,000 tons. As might have been expected, there was a notable decline in the world's prices for hops, and the same quality of English hops which commanded 700*s*. per cwt. in 1882 sold for 74*s*. in 1887, and in June, 1888, for 68*s*. Later in the year, with unfavorable harvest reports, the price advanced to 147*s*.

DIAMONDS.

The recent price experience of diamonds is in the highest degree interesting. Diamonds were first discovered in South Africa about the year 1868, and a business of searching (mining) for them immediately sprang up. At the outset the mining was conducted by individuals, but, in consequence of the expense, the work gradually and necessarily passed into the control of joint-stock companies with command of large capital; and it was not until 1880 that operations on a great scale were undertaken. The result of

this improved system, conjoined with underground mining, was such an increase in the output of diamonds that an oversupply to the market and a serious reduction in price became imminent; and the period of 1883–'84 was, in fact, one of falling prices and intense competition among the various producing companies, during which the leading companies paid little or nothing to their shareholders, and some entirely suspended operations.* Continued disaster was, however, finally arrested through a practical consolidation of all the companies for the purpose of controlling product and prices; and a revival in demand having occurred about the same time, average prices were advanced between 1885 and 1887 from 20*s.* 5*d.* per carat to 23*s.* 7½*d.*

The value of the diamonds exported from South Africa since the first discovery of the mines, or from 1868 to 1887, is believed to have been between £40,000,000 and £45,000,000 ($200,000,000 to $225,000,000), of which about £15,500,000 ($77,500,000) represents the value of the output from 1883 to 1887. Very curiously, this large export of value—nearly all in the first instance to England—seems to find no distinctive place in the columns of British imports, although they have served in a large measure to enable South Africa to pay for her imports of British and other foreign products. If the export of diamonds from South Africa to Europe has aggregated £45,000,000 ($225,000,000) in the rough, the process of cutting may be regarded as having increased their market value full one hundred per cent, or to £90,000,000 (or $437,000,000)—a greater value than the yield of the world during the two preceding centuries. The aggregate weight of the entire diamond product of the South African mines up to 1887 is estimated at 38,000,000 carats, or over seven and a half tons.

Of this immense product there is good reason for believing that a very large proportion found a market in the United States. According to the customs returns, the value of the unset diamonds which were imported into the United States, and paid duty, from 1877 to 1887 inclusive, was in excess of $50,000,000; and it can hardly be doubted that an equal or larger import in the form of unset stones and jewelry escaped during the same period the cognizance of the revenue officials. The value of the present annual import of precious stones not set—mainly diamonds—is about $10,000,000. In 1868 the annual value of a corresponding import was about $1,000,000. These data, imperfect as they are,

* The "Kimberly Central Company"—the leading organization—which from 1880 to 1883 increased its dividend from ten to thirty per cent, paid nothing to its shareholders during 1884 and 1885, and at the close of 1886 was only able to declare a dividend of five per cent. The other great diamond-mining company, the "De Beers," was more fortunate, and paid for 1884 to 1886 an average of about eight and a half per cent; but most of the companies paid nothing during the same period, and some entirely suspended mining.

afford some indication of the rapid increase in wealth in recent years among the people of the United States.

We have, therefore, in this experience, the phenomenon of the strangely persistent value of a comparatively useless gem, during a period when the prices of most other commodities were diminishing by leaps and bounds, as well as the extraordinary concurrent absorbent power of the world for a greatly increased product. But the demand for diamonds latterly is thought not to have kept pace with their increasing production; and it is said that the stock of diamonds in the hands of dealers in 1888 was fully twenty-five per cent in excess of their requirements. To meet and neutralize the influence of this condition of affairs, the South African diamond-mining companies have limited production, which for the time has advanced prices. But the tendency obviously is for diamonds to decline in value; and the wonder, indeed, is that this has not happened at an earlier date. "One thing, furthermore, seems certain, and that is, that when the breakdown of speculation and prices does occur, the consequences will be singular and far-reaching. For it is to be remembered that for the most part the use of diamonds is a mere whim of fashion, that may change at any time. There is no way of stimulating the demand for them, except by lowering prices, and, of course, if prices were materially reduced, the wealthy votaries of fashion would inevitably cease to wear diamonds, and would take up some other form of personal adornment."* The price experience of diamonds in the near future promises, therefore, to be even more interesting than it has been in the recent past.

In the United States during recent years there has been a remarkable decline in the price of hides and in certain descriptions of leather; "Buenos Ayres" hides having sold in May, 1889, at the lowest figures for thirty years, while the leather trade generally has been depressed and unsatisfactory. The agency occasioning the first result is ascribed to the great increase in the supply of domestic hides consequent upon a notable extension of the American (Western) cattle industry; and, in the case of the second, to an over-production and decline in demand for upper-leather, in consequence of a change in fashion, whereby lighter grades of foot-wear have supplemented the use of "leg-boots."

CHANGES OF INDUSTRIAL CONDITIONS IN TROPICAL COUNTRIES.

The improvements in recent years in the production of sugar from the beet, and the artificial encouragement of this industry in the continental states of Europe through the payment of large bounties, have in turn compelled the *large* producers of cane-sugars in the tropics to entirely abandon their old methods of working,

* London "Economist."

and reorganize this industry on a most gigantic scale as a condition of continued existence. Thus, for example, although the business of cane-sugar production was commenced more than three hundred years ago on the island of Cuba, the grinding of the cane by animal or "wind" power, and the boiling and granulating by ancient, slow, and wasteful methods, were everywhere kept up until within a very recent period, as they still are by small planters in every tropical country. But at the present time, upon the great plantations of Cuba and some other countries, the cane is conveyed from the fields by a system of railroads to manufacturing centers, which are really huge factories, with all the characteristics of factory life about them, and with the former home or rural idea connected with this industry completely eliminated. In these factories, where the first cost of the machinery plant often represents as large a sum as $200,000 to $250,000, with an equally large annual outlay for labor and other expenses, all grades of sugar from the "crude" to the "partially refined" are manufactured at a cost that once would not have been deemed possible. In Dakota and Manitoba the employment on single wheat estates of a hundred reapers and an aggregate of three hundred laborers for a season has been regarded as something unprecedented in agricultural industry; but on one sugar estate in Cuba—"El Balboa"—from fifteen hundred to two thousand hands, invariably negroes, are employed, who work under severe discipline, in watches or relays, during the grinding season, by day and night, the same as in the large iron-mills and furnaces of the United States and Europe. At the same time there are few village communities where a like number of people experience the same care and surveillance. The male workers occupy quarters walled and barricaded from the women, and the women from the men. There are in every village an infirmary, a lying-in hospital, a physician, an apothecary, a chapel, and priest. At night and morning mass is said in chapel, and the crowds are always large. There is of a Sunday less restraint, though ceaseless espionage is never remitted. On these days and in parts of holidays there are rude mirth, ruder music, and much dancing. This picture is given somewhat in detail, because it illustrates how all-pervading and tremendous are the forces that are modifying society everywhere, in civilized, partially civilized, and even barbarous countries, conjointly with the new conditions of production and consumption.

THE English Society for Promoting the Growth of Industrial Villages has been formed to counteract the tendency of workingmen to huddle themselves in the slums of cities, and to encourage suburban settlements. Its report cites, in illustration of the practical working of this thought, the example of a manufacturing firm in London, which has placed many of its hands in the country, and sends out material to them to be returned manufactured, paying them full wages.

THE SURFACE TENSION OF LIQUIDS.

By W. H. LARRABEE.

WHAT is it that keeps a drop of water in shape; that enables it to resist a considerable pressure or blow before it will collapse into a spatter; that holds it in its integrity to a leaf or the eaves till it is mature to fall, while it still maintains its round, independent individuality? Whatever the power is, it appears yet more distinctly in a globule of mercury, which will not be hammered out of shape or compelled to spread. Dr. Thomas Young conceived, for the explanation of this and some other phenomena exhibited by small, isolated liquid masses, the idea of their being surrounded by a thin, elastic membrane, less dense than the deeper parts of the drop, and capable of adhering perfectly to them, and more or less strongly to solid bodies. It seemed capable of opposing a certain resistance to being rent, and this was called its superficial tension. Some curious movements take place when certain solid substances are cast upon water, to account for which Dutrochet supposed a new force, which he called epipolic force. These phenomena of the drops, the "epipolic force," the calming effects of oil on storm-disturbed water, and a variety of other curious actions hitherto unaccounted for, have lately been referred to this property of superficial tension. Taking a drop of water as typically embodying the property, M. E. Gossart* asserts that all the energies of nature may be found in its tenuous envelope. Besides M. Gossart, studies of the curious and protean properties of this superficial tension, or the envelope of the water-drop, have been published by M. H. Devaux† and M. Van der Mensbrugghe.‡ The present article is a summary of some of the results of their studies. Regarding water in a vessel, M. Van der Mensbrugghe finds that whatever may once have been thought on the subject, it is not equally constituted throughout. Its particles are solicited by attractive forces which are exhibited when, upon drawing out a pencil which has been dipped into the mass, a drop is found adhering to the point. If this drop be conceived to be cut by a horizontal plane, all the parts below the plane may be supposed to be sustained by those which are above it. It is also acted upon by repulsive forces tending to scatter the particles, the effects of which are seen in evaporation. When the

* "A Voyage on the Surface of a Drop of Water." Lecture before the Scientific and Literary Society of Caen, published in the "Revue Scientifique," 1887.

† "Spontaneous Movements of certain Bodies on the Surface of some Liquids," "La Nature," 1888.

‡ "Superficial Tension." Lecture before the Belgian Society of Microscopy, March 3, 1888, published in "La Nature," 1888.

attractive and repulsive forces are at equilibrium within the liquid, there is supposed to be in the immediate vicinity of the free surface a tendency to the dispersion of the particles which is constantly opposed by the attractive forces. The condition of the superficial layer may be compared with that of a thin, elastic membrane under stretch, the cohesion of which constantly opposes itself to a more considerable elongation. The superficial layer of a liquid is thus subject to a contractile force or tension, by virtue of which it tends to become as small as possible. M. Gossart, comparing the relative situation of two molecules, *A* within the drop, and *B* at its surface, against the air or another liquid or a solid body, shows that each molecule is attracted by the others only from a certain distance (less than ten thousandth of a millimetre), which is as formidably great to it as it seems little to us. Those molecules which are at a greater distance from *A* and *B* will have no more action upon them than the stars have upon our sun, earth, and planets. Regarding these spheres alone, *A*, equally solicited in all directions by an equal number of molecules, will be free in its movements, and obedient to Pascal's principle; while *B* has not the same surrounding in every direction. Hence a kind of rarefaction which extends to only a slight depth in the drop; and hence also, on the surface, the elastic membranous or resistant quality.

This property is illustrated in some experiments described by M. Van der Mensbrugghe. Take two pencils, one of which should be of light wood and thinner than the other (Fig. 1); place them alongside and in contact; drop a little clear water in the angle between them, so as to moisten the line of contact. There will be formed a slight liquid mass, adherent to both pencils, of concave outline, the section of which is represented by *a b* in the corner diagram of Fig. 1. The lighter pencil will hang from the other by virtue of the tension of the concave surfaces *a b*, that bound either side of the line of contact. With the pencils twelve centimetres long, a weight of eighteen hundred milligrammes may be sustained in this way. In a second experiment, a ring of copper wire a millimetre thick and three and one quarter inches in diameter, is laid carefully upon the surface of pure water, when —if everything be entirely clean—it will float, as in Fig. 2, section *a*, and this, notwithstanding copper is 8·8 times heavier than water. This takes place because all the tensions of the liquid that touches upon the ring produce an upward resultant. A ring weighing seventeen hundred and thirty milligrammes may be thus upheld, while the maximum effect of the tensions is three thousand seven hundred and seventy milligrammes, or more than double the weight of the ring. Needles, globules of mercury, a thin ring of platinum, etc., may be similarly made to float on water.

In a third experiment a strip of thin, unglazed paper, say six inches and three quarters long by an inch and a half wide, is folded so as to form a box or trough, as represented in the lower part of Fig. 3. Set the box on a table, moisten the inner faces with a wet brush, and pour in water from an inch or two above. The tension of the liquid surface will at once bring the long sides of the box together, and the vessel will thus shut upon itself.

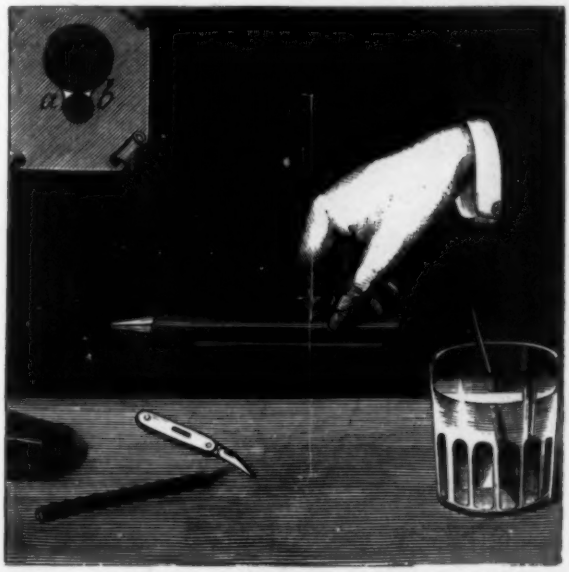


FIG. 1.—ADHERENCE OF ONE PENCIL TO ANOTHER BY THE TENSION OF CONCAVE SURFACES OF WATER.

Again, take a cylindrical cork of about wine-bottle size; fix in the center of one end a fine iron wire terminating in a hook or pan to hold ballast. In the other end fix a ring about four inches in diameter, lifted on branching supports as in Fig. 4. Plunge the apparatus into a vessel containing a suitable depth of water. With a proper weight of ballast, the cork will assume a vertical position, and will rise only to a certain distance above the level of the water. But if the whole is pushed down into the liquid and left there, the ring will not again clear itself from the water; it will only rise a little above its level, producing a double concave meniscus. In this case the effect of superficial tension is to give rise to a downward resultant sufficient to counterbalance the increase of the upward thrust. If the ballast is managed so that the excess of this resultant is but slight, on the application of ether by a wad or sponge, the effect of which will be to diminish the superficial tension of the water, the ring will rise from the liquid and the apparatus assume its original position.

In a fifth experiment a square frame of wire is dipped into a

mixture of soap and sugar with water. On withdrawing the frame its inner space will be occupied with a flat film of so little weight that it does not visibly sag, but becomes more tense as it is attenuated. A closed contour of cotton or silk thread laid upon the film will lie in any form so long as the film is whole and its tension equal in every direction. But the instant it is broken

FIG. 2.—COPPER RING FLOATING ON THE SURFACE OF WATER.

within the contour the thread will stretch and assume a circular form as in Fig. 5, under the influence of the outward tensions of the rest of the film. It takes the shape in which it bounds as great a surface as its length permits, which is that of a circle. Prof. Schoentjes has varied upon this experiment by using, instead of a simple thread, a system composed of portions of rectilinear solids and portions of arbitrary form, made by passing threads loosely through pieces of fine straws (as in the object lying on the table in Fig. 5). This being placed upon the film and the film pierced, as in the previous experiment, invariably assumed a shape in which all the loose thread portions became arcs of a single circumference, of which the rectilinear solid portions (the straws) constituted chords—or the figure, according to Steiner, of the maximum surface that can be limited by a contour so composed. M. Terquem and M. Gossart, by breaking the film at one or more points outside of the contour, make the thread double into loops.

M. Gossart has studied the pressure of this supposed membrane surrounding the drop of water, and its variation under different degrees of curvature. Investigating its behavior in a

homogeneous medium, he takes the envelope itself—a drop void of water, or rather full of air—represented for convenience of manipulation by a soap-bubble, and consisting of two films separated by an extremely thin mass of water. The pressure is the same in every part, and the curvature uniform, and that which gives the least possible surface—a sphere. The pressure is strong enough to drive tobacco-smoke back through a pipe-stem or to blow out a candle. The curved film may be deformed by passing it through rigid frames, but it will always preserve a geometrical shape, for it can not continue to exist except upon the condition of exercising an equal pressure throughout upon the air imprisoned within it; but some of the shapes it will assume within this rule are very curious.

If a drop of water is poured upon another liquid, it is still imprisoned in its contractile sac, but in one having two walls of unequal elasticity; the upper wall resting against the air, and the lower one against the liquid. The line of suture of these two

FIG. 3.—A PAPER BOX CLOSING UPON ITSELF WHEN WATER IS POURED INTO IT.

walls floats in three different media—air, water, and the subjacent liquid; or, to use M. Gossart's figure, it is like a cord drawn by three different forces, which are represented in this case by the upper and lower walls of the sac and the uncovered membrane of the inferior liquid, pulling against one another, as when three ropes are pulled by three men of unequal strength. Suppose, as the extreme case, that the attraction of the membrane exterior to the drop so prevails over the tension of the two walls of the sac that they can not rest in equilibrium. Then the sac will be drawn

out, and all the superior liquid will spread in an infinitely thin layer over the other. This is what happens to a drop of oil when it is thrown upon water. When a liquid is brought in contact with a solid, as when a first drop of water is let fall upon a horizontal plate of glass, the inclosing sac is flattened where it is in touch with the glass, and bulges where it is in contact with the air. The form of the sac and the angle of its junction with the glass are determined by the fact that the two tensions of the envelope,

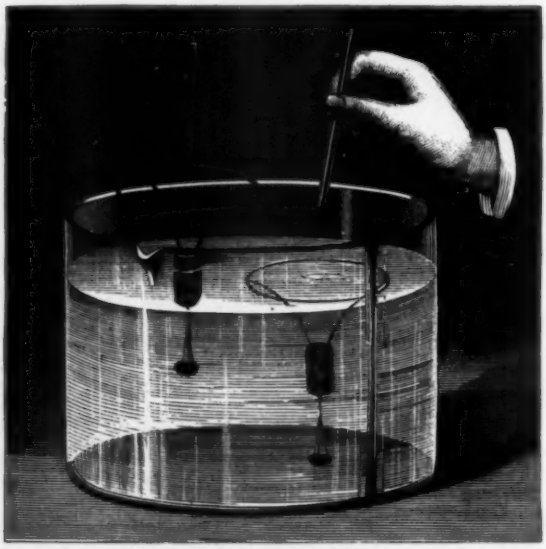


FIG. 4.—AN IRON RING HAVING BEEN PLUNGED UNDER WATER, HOLDING DOWN THE CORK TO WHICH IT IS ATTACHED.

the upper and lower, should balance the traction of the exterior glass upon the cordon separating them. In the case of a drop of alcohol, the tensions being much weaker, can not resist the traction of the glass, and the liquid spreads out at once, as also happens with water when the plate has already been moistened. Mercury opposes a very strong tension, and is hardly flattened at all on striking the glass. A drop of water cast upon a hot plate also exhibits a superior tension, and assumes the spheroidal state, which was first analyzed in 1850 by M. Boutigny, of Evreux. He said, "Bodies in a spheroidal state are bounded by a film of matter, the molecules of which are so connected that we can compare them to a solid, transparent, very thin, very elastic envelope, probably less dense than the rest, that protects the liquid within it against any too considerable heating."

This force of superficial tension exists and is manifest in all liquids, but in different degrees. It is stronger in water than in any other of the common liquids except mercury. Its value has been measured, and is usually expressed, in milligrammes per milli-

metre of superficial length, at 60° Fahr., as 7·5 for distilled water; 49 for mercury; 4 for glycerin; 3·6 for olive-oil; 2·8 for soap-suds; 2·7 for spirits of turpentine; 2·6 for petroleum; 2·5 for absolute alcohol; and 1·88 for ether. It is diminished when the liquid is warmed, and is weakened and even destroyed by impurity. M. Terquem has determined, from observations on the interference of luminous rays, that the envelope is less than $\frac{1}{20,000}$ of a millimetre thick.

Curious effects appear when liquids having different superficial tensions are brought together, and when solids containing volatile properties are thrown upon a liquid. With two liquids that will mix, as water and alcohol or ether, the tension at the point of contact becomes null, and the lighter fluid spreads out over the other. This is followed, according to M. Van der Mens-

FIG. 5.—A CONTOUR OF SILKEN THREAD EXPANDING INTO A CIRCLE WHEN THE FILM ON WHICH IT HAS BEEN LAID IS BROKEN.

brugghe, by a retreat of this fluid toward the point where it was dropped, in consequence of an increased tension given to that point by the cooling that follows the evaporation of the dropped liquid. If the liquids will not mingle, as when oil or turpentine is dropped on water, the drop spreads over the surface, forming a thin layer upon it which is marked by beautiful plays of colors.

M. Devaux exemplifies one of these effects by an experiment (Fig. 6) in which a tin boat, having a notch cut in the stern, is launched upon the water. On letting a drop of alcohol fall at the notch, the boat moves away as if driven by some repulsion. There is, however, no repulsion; but the tension astern has been

destroyed or diminished, while that forward continues in full force to draw the boat onward. If a bit of camphor be substituted for the alcohol, its vapor has the same effect upon the ten-

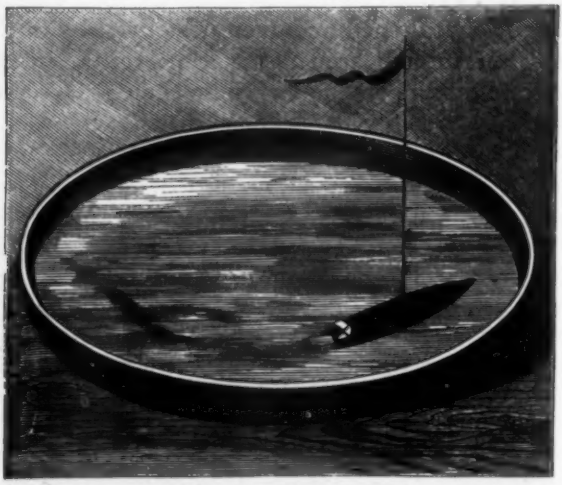


FIG. 6.—TIN BOAT SAILING AROUND ON WATER BY THE AID OF A BIT OF CAMPHOR.

sion, and the boat may be made to sail regularly, with considerable speed, for hours. The experiment is made more spectacular by furnishing the boat with a mast carrying a flag.

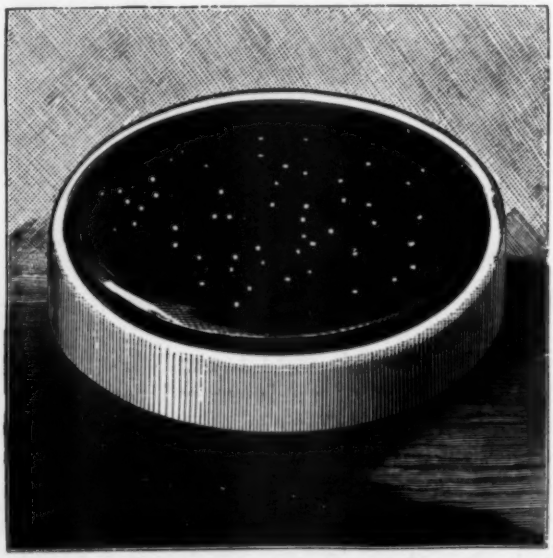


FIG. 7.—MOVEMENTS OF FINE GRAINS OF CAMPHOR ON THE SURFACE OF MERCURY.

In another experiment described by M. Devaux, a few granules of camphor are sprinkled upon mercury, and breathed upon till a kind of lye is formed, when a multitude of long-tailed "tadpoles"

appear swimming over the surface of the mercury (Fig. 7). If, now, we breathe continuously from one side upon the mercury, the "tadpoles" will become more lively, and direct themselves against the breath, coming up to the very edge of the mercury. The breath, driving the vapors back, clears a space in front of the "tadpole," leaving the tension of the mercury free to act upon it and draw it forward, while it clouds the rear, weakening the tension.

M. Devaux has exemplified the strength and persistence of the tensional force by connecting his camphor-boat with a float in the shape of a watch-glass. The movement of the boat continues, car-

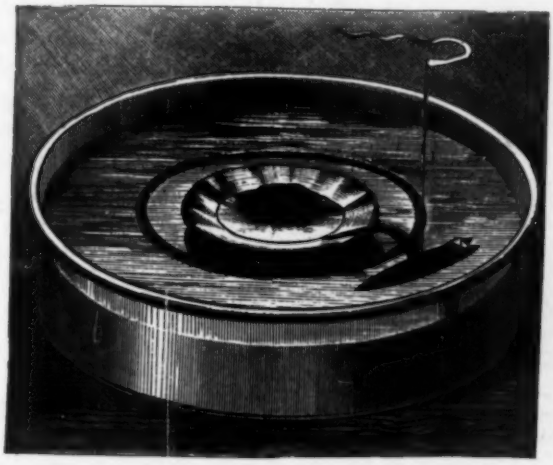


FIG. 8.—TIN BOAT CAUSING A LOADED FLOAT TO GO ROUND WITH IT.

rying the float around while it is loaded with weights rising to fifty or a hundred grammes, and even to a kilogramme (Fig. 8); and if forcibly stopped, it will begin again when the obstacle is removed.

The phenomena of capillary attraction are explained under the theory of superficial tension. The liquid rises in the tubes by virtue of the adhesion of its superficial membrane to their walls, and to a less height in the larger than in the smaller tubes because the mass of the liquid to be raised increases more rapidly than the power of the membrane to sustain it. Just as the tension of a liquid is diminished by adding a foreign substance, the capillary force of a tube is diminished by the presence of a foreign vapor. This is illustrated by M. Devaux as in Fig. 9, where water rises to the greatest height in the tube A, which was filled simply with air, to a less height in E, which has been charged with the vapor of ether, and to a still less height in C, which was occupied with the vapor of camphor.

Other energies than this mechanical energy have been shown

by different investigators to reside in the thin envelope of the water-drop; acoustic energy by M. Savart, as noticed in a cascade of water-drops, the envelopes of which underwent rhythmical deformations; calorific energy, due to the displacement of molecules that pass from the surface to the ranks, or which ascend to the superficial layer; luminous energy, as studied by Newton, Boyle, Hooke, Young, and Fresnel; and electrical energy, as manifested in effects that have been observed by M. Lipmann—all of which, according to M. Gossart, are transformable one into another in accordance with the law of conservation of force.

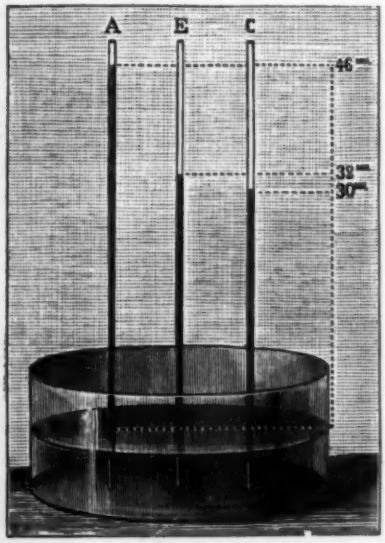


FIG. 9.—LEVELS TO WHICH WATER WILL RISE IN CAPILLARY TUBES CHARGED, RESPECTIVELY, WITH AIR (A), VAPOR OF ETHER (E), AND CAMPHOR-VAPOR (C).

A drop of water hangs from a leaf or the eaves of a house, held up as in a bag by its superficial envelope. It continues to increase in size and weight many times faster than the tension of its cordon of attachment is re-enforced, till it overcomes that tension, and then it falls; and, according to M. Gossart, all the drops of water that fall—of themselves—are of the same size. The drops of melted metals, whose superficial tensions are enormous, reach correspondingly enormous magnitude. The purity of liquids can be determined by observing the size of the drops they give; in the case of wines, by counting the number of drops per cubic centimetre; for the superficial tension of all liquids is modified by adulteration.

M. Van der Mensbrugghe has calculated what he calls the potential energy of water, on the basis of the estimation of its superficial tension at 7·5 milligramme-millimetres per square millimetre of free surface. This is resident in a film not more than $\frac{1}{10,000}$ of a millimetre thick. Distributed over the whole ocean, it gives an amount of mechanical force which we have no means of accurately calculating. If we suppose that of two equal and adjacent superficial layers of sea-water, one washes over the other by the effect of the wind, for example, the layer that is covered loses its free surface, and with it its proper potential energy, which appears again in an increase of speed. Thus on the ocean the action goes on, the energies of the successive waves being extinguished as to them and transferred to others; so that

every wave in course of formation is composed of portions the speeds of which are greatest toward the top. In a violent wind the acceleration produces on each wave a crest that becomes more and more protuberant, and at length is disintegrated, or breaks. It follows that any agent capable of preventing the washing of the superficial slices over one another will constitute an obstacle to the progressive increase of the living force of the liquid masses.

Such an agent is found in oil when it covers a sufficient extent of the surface of the sea. By virtue of its specific levity it keeps on the surface and prevents the washing of one layer of water over another. Thus is explained the soothing action, which appears so mysterious at first sight, of oils upon rough seas. Susceptible of being spread out into laminæ of the incredible thinness of $\frac{1}{100,000}$ or $\frac{1}{200,000}$ of a millimetre, a small quantity of oil is efficacious to cover and prevent overwashing of waves upon a large surface. When this is done, the formation of the crests or breaking waves, so dangerous to ships, can not take place, and the terrible breaker is converted into a harmless swell.

THE VALUE OF WITNESS TO THE MIRACULOUS.

By Prof. T. H. HUXLEY, F.R.S.

CHARLES, or, more properly, Karl, King of the Franks, consecrated Roman emperor in St. Peter's, on Christmas day, A. D. 800, and known to posterity as the Great (chiefly by his agglutinative Gallicized denomination of Charlemagne), was a man great in all ways, physically and mentally. Within a couple of centuries after his death Charlemagne became the center of innumerable legends; and the myth-making process does not seem to have been sensibly interfered with by the existence of sober and truthful histories of the emperor and of the times which immediately preceded and followed his reign, by a contemporary writer who occupied a high and confidential position in his court, and in that of his successor. This was one Eginhard, or Einhard, who appears to have been born about A. D. 770, and spent his youth at the court, being educated along with Charles's sons. There is excellent contemporary testimony not only to Eginhard's existence, but to his abilities, and to the place which he occupied in the circle of the intimate friends of the great ruler whose life he subsequently wrote. In fact, there is as good evidence of Eginhard's existence, of his official position, and of his being the author of the chief works attributed to him, as can reasonably be expected in the case of a man who lived more than

a thousand years ago, and was neither a great king nor a great warrior. These works are—1. "The Life of the Emperor Karl." 2. "The Annals of the Franks." 3. "Letters." 4. "The History of the Translation of the Blessed Martyrs of Christ, SS. Marcellinus and Petrus."

It is to the last, as one of the most singular and interesting records of the period during which the Roman world passed into that of the middle ages, that I wish to direct attention.* It was written in the ninth century, somewhere, apparently, about the year 830, when Eginhard, ailing in health and weary of political life, had withdrawn to the monastery of Seligenstadt, of which he was the founder. A manuscript copy of the work, made in the tenth century, and once the property of the monastery of St. Bavon on the Scheldt, of which Eginhard was abbot, is still extant, and there is no reason to believe that, in this copy, the original has been in any way interpolated or otherwise tampered with. The main features of the strange story contained in the "Historia Translationis" are set forth in the following pages, in which, in regard to all matters of importance, I shall adhere as closely as possible to Eginhard's own words:

While I was still at court, busied with secular affairs, I often thought of the leisure which I hoped one day to enjoy in a solitary place, far away from the crowd, with which the liberality of Prince Louis, whom I then served, had provided me. This place is situated in that part of Germany which lies between the Neckar and the Main,† and is nowadays called the Odenwald by those who live in and about it. And here having built, according to my capacity and resources, not only houses and permanent dwellings, but also a basilica fitted for the performance of divine service and of no mean style of construction, I began to think to what saint or martyr I could best dedicate it. A good deal of time had passed while my thoughts fluctuated about this matter, when it happened that a certain deacon of the Roman Church, named Deusdona, arrived at the court for the purpose of seeking the favor of the king in some affairs in which he was interested. He remained some time; and then, having transacted his business, he was about to return to Rome, when one day, moved by courtesy to a stranger, we invited him to a modest refection; and while talking of many things at table, mention was made of the translation of the body of the blessed Sebastian,‡ and of the neglected tombs of the martyrs, of which there is such a prodigious number at Rome; and the conversation having turned toward the dedication of our new basilica, I began to inquire how it might be possible for me to obtain some of the true relics of the saints which rest at Rome. He at first hesitated, and declared that he did not know how that could be done. But observing that I was both anxious and curious about the subject, he promised to give me an answer some other day.

* My citations are made from Teulet's "Einhardi omnia quæ extant opera," Paris, 1840–1843, which contains a biography of the author, a history of the text, with translations into French, and many valuable annotations.

† At present included in the duchies of Hesse-Darmstadt and Baden.

‡ This took place in the year 826 A. D. The relics were brought from Rome and deposited in the Church of St. Medardus at Soissons.

When I returned to the question, some time afterward, he immediately drew from his bosom a paper, which he begged me to read when I was alone, and to tell him what I was disposed to think of that which was therein stated. I took the paper, and, as he desired, read it alone and in secret. (Cap. i, 2, 3.)

I shall have occasion to return to Deacon Deusdona's conditions, and to what happened after Eginhard's acceptance of them. Suffice it, for the present, to say that Eginhard's notary, Ratleicus (Ratleig), was dispatched to Rome and succeeded in securing two bodies, supposed to be those of the holy martyrs Marcellinus and Petrus; and when he had got as far on his homeward journey as the Burgundian town of Solothurn or Soleure,* notary Ratleig dispatched to his master, at St. Bavon, a letter announcing the success of his mission.

As soon as by reading it I was assured of the arrival of the saints, I dispatched a confidential messenger to Maestricht, to gather together priests, other clerics, and also laymen, to go out to meet the coming saints as speedily as possible. And he and his companions, having lost no time, after a few days met those who had charge of the saints at Solothurn. Joined with them, and with a vast crowd of people who gathered from all parts, singing hymns, and amid great and universal rejoicings, they traveled quickly to the city of Argentoratum, which is now called Strasburg. Thence embarking on the Rhine they came to the place called Portus,† and landing on the east bank of the river, at the fifth station, thence they arrived at Michilinstadt,‡ accompanied by an immense multitude, praising God. This place is in that forest of Germany which in modern times is called the Odenwald, and about six leagues from the Main. And here, having found a basilica recently built by me, but not yet consecrated, they carried the sacred remains into it and deposited them therein, as if it were to be their final resting-place. As soon as all this was reported to me, I traveled thither as quickly as I could. (Cap. ii, 14.)

Three days after Eginhard's arrival began the series of wonderful events which he narrates, and for which we have his personal guarantee. The first thing that he notices is the dream of a servant of Ratleig the notary, who, being set to watch the holy relics in the church after vespers, went to sleep, and during his slumbers had a vision of two pigeons, one white and one gray and white, which came and sat upon the bier over the relics; while, at the same time, a voice ordered the man to tell his master that the holy martyrs had chosen another resting-place and desired to be transported thither without delay.

Unfortunately, the saints seem to have forgotten to mention where they wished to go, and, with the most anxious desire to gratify their smallest wishes, Eginhard was naturally greatly perplexed what to do. While in this state of mind, he was one day

* Now included in western Switzerland.

† Probably, according to Teulet, the present Sandhofer-fahrt, a little below the embouchure of the Neckar.

‡ The present Michilstadt, thirty miles northeast of Heidelberg.

contemplating his "great and wonderful treasure, more precious than all the gold in the world," when it struck him that the chest in which the relics were contained was quite unworthy of its contents; and after vespers he gave orders to one of the sacristans to take the measure of the chest in order that a more fitting shrine might be constructed. The man, having lighted a wax candle and raised the pall which covered the relics, in order to carry out his master's orders, was astonished and terrified to observe that the chest was covered with a blood-like exudation (*loculum mirum in modum humore sanguineo undique distillantem*), and at once sent a message to Eginhard.

> Then I and those priests who accompanied me beheld this stupendous miracle, worthy of all admiration. For just as when it is going to rain, pillars and slabs and marble images exude moisture, and, as it were, sweat, so the chest which contained the most sacred relics was found moist with the blood exuding on all sides. (Cap. ii, 16.)

Three days' fast was ordained in order that the meaning of the portent might be ascertained. All that happened, however, was that at the end of that time the "blood," which had been exuding in drops all the while, dried up. Eginhard is careful to say that the liquid "had a saline taste, something like that of tears, and was thin as water, though of the color of true blood," and he clearly thinks this satisfactory evidence that it was blood.

The same night another servant had a vision, in which still more imperative orders for the removal of the relics were given; and, from that time forth, "not a single night passed without one, two, or even three of our companions receiving revelations in dreams that the bodies of the saints were to be transferred from that place to another." At last a priest, Hildfrid, saw, in a dream, a venerable white-haired man in a priest's vestments, who bitterly reproached Eginhard for not obeying the repeated orders of the saints, and upon this the journey was commenced. Why Eginhard delayed obedience to these repeated visions so long does not appear. He does not say so in so many words, but the general tenor of the narrative leads one to suppose that Mulinheim (afterward Seligenstadt) is the "solitary place" in which he had built the church which awaited dedication. In that case all the people about him would know that he desired that the saints should go there. If a glimmering of secular sense led him to be a little suspicious about the real cause of the unanimity of the visionary beings who manifested themselves to his *entourage* in favor of moving on, he does not say so.

At the end of the first day's journey the precious relics were deposited in the church of St. Martin, in the village of Ostheim. Hither a paralytic nun (*sanctimonialis quædam paralytica*) of the

name of Ruodlang was brought in a car by her friends and relatives from a monastery a league off. She spent the night watching and praying by the bier of the saints; "and health returning to all her members, on the morrow she went back to her place whence she came, on her feet, nobody supporting her, or in any way giving her assistance." (Cap. ii, 19.)

On the second day the relics were carried to Upper Mulinheim, and finally, in accordance with the orders of the martyrs, deposited in the church of that place, which was therefore renamed Seligenstadt. Here, Daniel, a beggar boy of fifteen, and so bent that "he could not look at the sky without lying on his back," collapsed and fell down during the celebration of the mass. "Thus he lay a long time, as if asleep, and all his limbs straightening and his flesh strengthening (*recepta firmitate nervorum*), he arose before our eyes, quite well." (Cap. ii, 20.)

Some time afterward an old man entered the church on his hands and knees, being unable to use his limbs properly:

> He, in the presence of all of us, by the power of God and the merits of the blessed martyrs, in the same hour in which he entered was so perfectly cured that he walked without so much as a stick. And he said that, though he had been deaf for five years, his deafness had ceased along with the palsy. (Cap. iii, 33.)

Eginhard was now obliged to return to the court at Aix-la-Chapelle, where his duties kept him through the winter; and he is careful to point out that the later miracles which he proceeds to speak of are known to him only at second hand. But, as he naturally observes, having seen such wonderful events with his own eyes, why should he doubt similar narrations when they are received from trustworthy sources?

Wonderful stories these are indeed, but as they are, for the most part, of the same general character as those already recounted, they may be passed over. There is, however, an account of a possessed maiden which is worth attention.

This is set forth in a memoir, the principal contents of which are the speeches of a demon who declared that he possessed the singular appellation of "Wiggo," and revealed himself in the presence of many witnesses, before the altar, close to the relics of the blessed martyrs. It is noteworthy that the revelations appear to have been made in the shape of replies to the questions of the exorcising priest, and there is no means of judging how far the answers are really only the questions to which the patient replied yes or no.

The possessed girl, about sixteen years of age, was brought by her parents to the basilica of the martyrs.

> When she approached the tomb containing the sacred bodies, the priest, according to custom, read the formula of exorcism over her head. When he began

to ask how and when the demon had entered her, she answered, not in the tongue of the barbarians, which alone the girl knew, but in the Roman tongue. And when the priest was astonished and asked how she came to know Latin, when her parents, who stood by, were wholly ignorant of it, "Thou hast never seen my parents," was the reply. To this the priest, "Whence art thou, then, if these are not thy parents?" And the demon, by the mouth of the girl, "I am a follower and disciple of Satan, and for a long time I was gatekeeper (janitor) in hell; but, for some years, along with eleven companions, I have ravaged the kingdom of the Franks." (Cap. v, 49.)

He then goes on to tell how they blasted the crops and scattered pestilence among beasts and men, because of the prevalent wickedness of the people.*

The enumeration of all these iniquities, in oratorical style, takes up a whole octavo page; and at the end it is stated, "All these things the demon spoke in Latin by the mouth of the girl."

And when the priest imperatively ordered him to come out, "I shall go," said he, "not in obedience to you, but on account of the power of the saints, who do not allow me to remain any longer." And, having said this, he threw the girl down on the floor and there compelled her to lie prostrate for a time, as though she slumbered. After a little while, however, he going away, the girl, by the power of Christ and the merits of the blessed martyrs, as it were awakening from sleep, rose up quite well, to the astonishment of all present; nor after the demon had gone out was she able to speak Latin: so that it was plain enough that it was not she who had spoken in that tongue, but the demon by her mouth. (Cap. v, 51.)

If the "Historia Translationis" contained nothing more than has been, at present, laid before the reader, disbelief in the miracles of which it gives so precise and full a record might well be regarded as hyper-skepticism. It might fairly be said: "Here you have a man, whose high character, acute intelligence, and large instruction are certified by eminent contemporaries; a man who stood high in the confidence of one of the greatest rulers of any age, and whose other works prove him to be an accurate and judicious narrator of ordinary events. This man tells you, in language which bears the stamp of sincerity, of things which happened within his own knowledge, or within that of persons in whose veracity he has entire confidence, while he appeals to his sovereign and the court as witnesses of others; what possible ground can there be for disbelieving him?"

Well, it is hard upon Eginhard to say so, but it is exactly the honesty and sincerity of the man which are his undoing as a witness to the miraculous. He himself makes it quite obvious that when his profound piety comes on the stage, his good sense and even his perception of right and wrong make their exit. Let us

* In the middle ages one of the most favorite accusations against witches was that they committed just these enormities.

go back to the point at which we left him, secretly perusing the letter of Deacon Deusdona. As he tells us, its contents were—

> that he (the deacon) had many relics of saints at home, and that he would give them to me if I would furnish him with the means of returning to Rome; he had observed that I had two mules, and, if I would let him have one of them and would dispatch with him a confidential servant to take charge of the relics, he would at once send them to me. This plausibly expressed proposition pleased me, and I made up my mind to test the value of the somewhat ambiguous promise at once;* so giving him the mule and money for his journey I ordered my notary Ratleig (who already desired to go to Rome to offer his devotions there) to go with him. Therefore, having left Aix-la-Chapelle (where the emperor and his court resided at the time) they came to Soissons. Here they spoke with Hildoin, abbot of the monastery of St. Medardus, because the said deacon had assured him that he had the means of placing in his possession the body of the blessed Tiburtius the martyr. Attracted by which promises he (Hildoin) sent with them a certain priest, Hunus by name, a sharp man (*hominem callidum*), whom he ordered to receive and bring back the body of the martyr in question. And so, resuming their journey, they proceeded to Rome as fast as they could. (Cap. i, 3.)

Unfortunately, a servant of the notary, one Reginbald, fell ill of a tertian fever, and impeded the progress of the party. However, this piece of adversity had its sweet uses; for, three days before they reached Rome, Reginbald had a vision. Somebody habited as a deacon appeared to him and asked why his master was in such a hurry to get to Rome; and when Reginbald explained their business, this visionary deacon, who seems to have taken the measure of his brother in the flesh with some accuracy, told him not by any means to expect that Deusdona would fulfill his promises. Moreover, taking the servant by the hand, he led him to the top of a high mountain and, showing him Rome (where the man had never been), pointed out a church, adding: "Tell Ratleig the thing he wants is hidden there; let him get it as quickly as he can and go back to his master"; and, by way of a sign that the order was authoritative, the servant was promised that from that time forth his fever should disappear. And as the fever did vanish to return no more, the faith of Eginhard's people in Deacon Deusdona naturally vanished with it (*et fidem diaconi promissis non haberent*). Nevertheless, they put up at the deacon's house near St. Peter da Vincula. But time went on and no relics made their appearance, while the notary and the priest were put off with all sorts of excuses—the brother to whom the relics had been confided was gone to Beneventum and not expected back for some time, and so on—until Ratleig and Hunus began to despair, and were minded to return, *infecto negotio.*

* It is pretty clear that Eginhard had his doubts about the deacon, whose pledge he qualifies as *sponsiones incertæ*. But, to be sure, he wrote after events which fully justified skepticism.

But my notary, calling to mind his servant's dream, proposed to his companion that they should go to the cemetery which their host had talked about without him. So, having found and hired a guide, they went in the first place to the basilica of the blessed Tiburtius in the Via Labicana, about three thousand paces from the town, and cautiously and carefully inspected the tomb of that martyr, in order to discover whether it could be opened without any one being the wiser. Then they descended into the adjoining crypt, in which the bodies of the blessed martyrs of Christ, Marcellinus and Petrus, were buried; and, having made out the nature of their tomb, they went away thinking their host would not know what they had been about. But things fell out differently from what they had imagined. (Cap. i, 7.)

In fact, Deacon Deusdona, who doubtless kept an eye on his guests, knew all about their manœuvres and made haste to offer his services, in order that, "with the help of God" (*si Deus votis eorum favere dignaretur*), they should all work together. The deacon was evidently alarmed lest they should succeed without *his* help.

So, by way of preparation for the contemplated *vol avec effraction*, they fasted three days; and then, at night, without being seen, they betook themselves to the basilica of St. Tiburtius, and tried to break open the altar erected over his remains. But the marble proving too solid, they descended to the crypt, and "having invoked our Lord Jesus Christ and adored the holy martyrs," they proceeded to prise off the stone which covered the tomb, and thereby exposed the body of the most sacred martyr Marcellinus, "whose head rested on a marble tablet on which his name was inscribed." The body was taken up with the greatest veneration, wrapped in a rich covering, and given over to the keeping of the deacon and his brother Lunison, while the stone was replaced with such care that no sign of the theft remained.

As sacrilegious proceedings of this kind were punishable with death by the Roman law, it seems not unnatural that Deacon Deusdona should have become uneasy, and have urged Ratleig to be satisfied with what he had got and be off with his spoils. But the notary having thus cleverly captured the blessed Marcellinus, thought it a pity he should be parted from the blessed Petrus, side by side with whom he had rested for five hundred years and more in the same sepulchre (as Eginhard pathetically observes); and the pious man could neither eat, drink, nor sleep, until he had compassed his desire to reunite the saintly colleagues. This time, apparently in consequence of Deusdona's opposition to any further resurrectionist doings, he took counsel with a Greek monk, one Basil, and, accompanied by Hunus, but saying nothing to Deusdona, they committed another sacrilegious burglary, securing this time, not only the body of the blessed Petrus, but a quantity of dust, which they agreed the priest should take, and tell his employer that it was the remains of the blessed Tiburtius.

How Deusdona was "squared," and what he got for his not very valuable complicity in these transactions, does not appear. But at last the relics were sent off in charge of Lunison, the brother of Deusdona, and the priest Hunus, as far as Pavia, while Ratleig stopped behind for a week to see if the robbery was discovered, and, presumably, to act as a blind if any hue and cry were raised. But, as everything remained quiet, the notary betook himself to Pavia, where he found Lunison and Hunus awaiting his arrival. The notary's opinion of the character of his worthy colleagues, however, may be gathered from the fact that, having persuaded them to set out in advance along a road which he told them he was about to take, he immediately adopted another route, and, traveling by way of St. Maurice and the Lake of Geneva, eventually reached Soleure.

Eginhard tells all this story with the most *naïve* air of unconsciousness that there is anything remarkable about an abbot, and a high officer of state to boot, being an accessory both before and after the fact to a most gross and scandalous act of sacrilegious and burglarious robbery. And an amusing sequel to the story proves that, where relics were concerned, his friend Hildoin, another high ecclesiastical dignitary, was even less scrupulous than himself.

On going to the palace early one morning, after the saints were safely bestowed at Seligenstadt, he found Hildoin waiting for an audience in the emperor's antechamber, and began to talk to him about the miracle of the bloody exudation. In the course of conversation, Eginhard happened to allude to the remarkable fineness of the garment of the blessed Marcellinus. Whereupon Abbot Hildoin replied (to Eginhard's stupefaction) that his observation was quite correct. Much astonished at this remark from a person who was supposed not to have seen the relics, Eginhard asked him how he knew that. Upon this, Hildoin saw that he had better make a clean breast of it, and he told the following story, which he had received from his priestly agent, Hunus: While Hunus and Lunison were at Pavia, waiting for Eginhard's notary, Hunus (according to his own account) had robbed the robbers. The relics were placed in a church, and a number of laymen and clerics, of whom Hunus was one, undertook to keep watch over them. One night, however, all the watchers, save the wide-awake Hunus, went to sleep; and then, according to the story which this "sharp" ecclesiastic foisted upon his patron—

it was borne in upon his mind that there must be some great reason why all the people, except himself, had suddenly become somnolent; and, determining to avail himself of the opportunity thus offered (*oblata occasione utendum*), he rose and, having lighted a candle, silently approached the chests. Then, having burned through the threads of the seals with the flame of the candle, he quickly opened

the chests, which had no locks;* and, taking out portions of each of the bodies which were thus exposed, he closed the chests and connected the burned ends of the threads with the seals again, so that they appeared not to have been touched; and, no one having seen him, he returned to his place. (Cap. iii, 23.)

Hildoin went on to tell Eginhard that Hunus at first declared to him that these purloined relics belonged to St. Tiburtius; but afterward confessed, as a great secret, how he had come by them, and he wound up his discourse thus:

They have a place of honor beside St. Medardus, where they are worshiped with great veneration by all the people; but whether we may keep them or not is for your judgment. (Cap. iii, 23.)

Poor Eginhard was thrown into a state of great perturbation of mind by this revelation. An acquaintance of his had recently told him of a rumor that was spread about, that Hunus had contrived to abstract *all* the remains of SS. Marcellinus and Petrus while Eginhard's agents were in a drunken sleep; and that, while the real relics were in Abbot Hildoin's hands at St. Medardus, the shrine at Seligenstadt contained nothing but a little dust. Though greatly annoyed by this "execrable rumor, spread everywhere by the subtlety of the devil," Eginhard had doubtless comforted himself by his supposed knowledge of its falsity, and he only now discovered how considerable a foundation there was for the scandal. There was nothing for it but to insist upon the return of the stolen treasures. One would have thought that the holy man, who had admitted himself to be knowingly a receiver of stolen goods, would have made instant restitution and begged only for absolution. But Eginhard intimates that he had very great difficulty in getting his brother abbot to see that even restitution was necessary.

Hildoin's proceedings were not of such nature as to lead any one to place implicit trust in anything he might say; still less had his agent, priest Hunus, established much claim to confidence; and it is not surprising that Eginhard should have lost no time in summoning his notary and Lunison to his presence, in order that he might hear what they had to say about the business. They, however, at once protested that priest Hunus's story was a parcel of lies, and that after the relics left Rome no one had any opportunity of meddling with them. Moreover, Lunison, throwing himself at Eginhard's feet, confessed with many tears what actually took place. It will be remembered that, after the body of St. Marcellinus was abstracted from its tomb, Ratleig deposited it in the house of Deusdona, in charge of the latter's brother, Lunison. But Hunus, being very much disappointed that he could not get

* The words are *scrinia sine clave*, which seem to mean "having no key." But the circumstances forbid the idea of breaking open.

hold of the body of St. Tiburtius, and afraid to go back to his abbot empty-handed, bribed Lunison with four pieces of gold and five of silver to give him access to the chest. This Lunison did, and Hunus helped himself to as much as would fill a gallon measure (*vas sextarii mensuram*) of the sacred remains. Eginhard's indignation at the "rapine" of this "nequissimus nebulo" is exquisitely droll. It would appear that the adage about the receiver being as bad as the thief was not current in the ninth century.

Let us now briefly sum up the history of the acquisition of the relics. Eginhard makes a contract with Deusdona for the delivery of certain relics which the latter says he possesses. Eginhard makes no inquiry how he came by them; otherwise, the transaction is innocent enough.

Deusdona turns out to be a swindler, and has no relics. Thereupon Eginhard's agent, after due fasting and prayer, breaks open the tombs and helps himself.

Eginhard discovers by the self-betrayal of his brother abbot, Hildoin, that portions of his relics have been stolen and conveyed to the latter. With much ado he succeeds in getting them back.

Hildoin's agent, Hunus, in delivering these stolen goods to him, at first declared they were the relics of St. Tiburtius, which Hildoin desired him to obtain; but afterward invented a story of their being the product of a theft, which the providential drowsiness of his companions enabled him to perpetrate from the relics which Hildoin well knew were the property of his friend.

Lunison, on the contrary, swears that all this story is false, and that he himself was bribed by Hunus to allow him to steal what he pleased from the property confided to his own and his brother's care by their guest Ratleig. And the honest notary himself seems to have no hesitation about lying and stealing to any extent, where the acquisition of relics is the object in view.

For a parallel to these transactions one must read a police report of the doings of a "long firm" or of a set of horse-coupers; yet Eginhard seems to be aware of nothing, but that he has been rather badly used by his friend Hildoin and the "nequissimus nebulo" Hunus.

It is not easy for a modern Protestant, still less for any one who has the least tincture of scientific culture, whether physical or historical, to picture to himself the state of mind of a man of the ninth century, however cultivated, enlightened, and sincere he may have been. His deepest convictions, his most cherished hopes, were bound up in the belief of the miraculous. Life was a constant battle between saints and demons for the possession of the souls of men. The most superstitious among our modern countrymen turn to supernatural agencies only when natural

causes seem insufficient; to Eginhard and his friends the supernatural was the rule, and the sufficiency of natural causes was allowed only when there was nothing to suggest others.

Moreover, it must be recollected that the possession of miracle-working relics was greatly coveted, not only on high but on very low grounds. To a man like Eginhard, the mere satisfaction of the religious sentiment was obviously a powerful attraction. But, more than this, the possession of such a treasure was an immense practical advantage. If the saints were duly flattered and worshiped, there was no telling what benefits might result from their interposition on your behalf. For physical evils, access to the shrine was like the grant of the use of a universal pill and ointment manufactory; and pilgrimages thereto might suffice to cleanse the performers from any amount of sin. A letter to Lupus, subsequently abbot of Ferrara, written while Eginhard was smarting under the grief caused by the loss of his much-loved wife Imma, affords a striking insight into the current view of the relation between the glorified saints and their worshipers. The writer shows that he is anything but satisfied with the way in which he has been treated by the blessed martyrs whose remains he has taken such pains to "convey" to Seligenstadt, and to honor there as they would never have been honored in their Roman obscurity:

> It is an aggravation of my grief and a reopening of my wound, that our vows have been of no avail, and that the faith which we placed in the merits and intervention of the martyrs has been utterly disappointed.

We may admit, then, without impeachment of Eginhard's sincerity, or of his honor under all ordinary circumstances, that when piety, self-interest, the glory of the Church in general, and that of the church at Seligenstadt in particular, all pulled one way, even the work-a-day principles of morality were disregarded; and, *a fortiori*, anything like proper investigation of the reality of the alleged miracles was thrown to the winds.

And if this was the condition of mind of such a man as Eginhard, what is it not legitimate to suppose may have been that of Deacon Deusdona, Lunison, Hunus, and company, thieves and cheats by their own confession; or of the probably hysterical nun; or of the professional beggars, for whose incapacity to walk and straighten themselves there is no guarantee but their own? Who is to make sure that the exorcist of the demon Wiggo was not just such another priest as Hunus; and is it not at least possible, when Eginhard's servants dreamed night after night in such a curiously coincident fashion, that a careful inquirer might have found they were very anxious to please their master?

Quite apart from deliberate and conscious fraud (which is a

rarer thing than is often supposed), people whose mythopœic faculty is once stirred are capable of saying the thing that is not, and of acting as they should not, to an extent which is hardly imaginable by persons who are not so easily affected by the contagion of blind faith. There is no falsity so gross that honest men, and, still more, virtuous women, anxious to promote a good cause, will not lend themselves to it without any clear consciousness of the moral bearings of what they are doing.

The cases of miraculously effected cures of which Eginhard is ocular witness appear to belong to classes of disease in which malingering is possible or hysteria presumable. Without modern means of diagnosis, the names given to them are quite worthless. One "miracle," however, in which the patient was cured by the mere sight of the church in which the relics of the blessed martyrs lay, is an unmistakable case of dislocation of the lower jaw in a woman; and it is obvious that, as not unfrequently happens in such accidents to weakly subjects, the jaw slipped suddenly back into place, perhaps in consequence of a jolt, as the woman rode toward the church. (Cap. v, 53.)*

There is also a good deal said about a very questionable blind man—one Albricus (Alberich ?)—who, having been cured, not of his blindness, but of another disease under which he labored, took up his quarters at Seligenstadt, and came out as a prophet, inspired by the archangel Gabriel. Eginhard intimates that his prophecies were fulfilled; but, as he does not state exactly what they were or how they were accomplished, the statement must be accepted with much caution. It is obvious that he was not the man to hesitate to "ease" a prophecy until it fitted, if the credit of the shrine of his favorite saints could be increased by such a procedure. There is no impeachment of his honor in the supposition. The logic of the matter is quite simple, if somewhat sophistical. The holiness of the church of the martyrs guarantees the reality of the appearance of the archangel Gabriel there, and what the archangel says must be true. Therefore, if anything seem to be wrong, that must be the mistake of the transmitter; and, in justice to the archangel, it must be suppressed or set right. This sort of "reconciliation" is not unknown in quite modern times, and among people who would be very much shocked to be compared with a "benighted papist" of the ninth century.

The readers of this review are, I imagine, very largely composed of people who would be shocked to be regarded as anything but enlightened Protestants. It is not unlikely that those of them

* Eginhard speaks with lofty contempt of the "*vana ac superstitiosa præsumptio*" of the poor woman's companions in trying to alleviate her sufferings with "herbs and frivolous incantations." Vain enough, no doubt, but the "mulierculæ" might have returned the epithet "superstitious" with interest.

who have accompanied me thus far may be disposed to say: "Well, this is all very amusing as a story; but what is the practical interest of it? We are not likely to believe in the miracles worked by the spolia of SS. Marcellinus and Petrus, or by those of any other saints in the Roman calendar."

The practical interest is this: If you do not believe in these miracles, recounted by a witness whose character and competency are firmly established, whose sincerity can not be doubted, and who appeals to his sovereign and other contemporaries as witnesses of the truth of what he says, in a document of which a MS. copy exists, probably dating within a century of the author's death, why do you profess to believe in stories of a like character which are found in documents, of the dates and of the authorship of which nothing is certainly determined, and no known copies of which come within two or three centuries of the events they record? If it be true that the four Gospels and the Acts were written by Matthew, Mark, Luke, and John, all that we know of these persons comes to nothing in comparison with our knowledge of Eginhard; and not only is there no proof that the traditional authors of these works wrote them, but very strong reasons to the contrary may be alleged. If, therefore, you refuse to believe that "Wiggo" was cast out of the possessed girl on Eginhard's authority, with what justice can you profess to believe that the legion of devils were cast out of the man among the tombs of the Gadarenes? And if, on the other hand, you accept Eginhard's evidence, why do you laugh at the supposed efficacy of relics and the saint-worship of the modern Romanists? It can not be pretended, in the face of all evidence, that the Jews of the year 30, or thereabout, were less imbued with the belief in the supernatural than were the Franks of the year A. D. 800. The same influences were at work in each case, and it is only reasonable to suppose that the results were the same. If the evidence of Eginhard is insufficient to lead reasonable men to believe in the miracles he relates, *a fortiori* the evidence afforded by the Gospels and the Acts must be so.*

But it may be said that no serious critic denies the genuineness of the four great Pauline Epistles—Galatians, First and Second Corinthians, and Romans—and that, in three out of these four, Paul lays claim to the power of working miracles.† Must we suppose, therefore, that the Apostle to the Gentiles has stated that which is false? But to how much does this so-called claim amount?

* Of course there is nothing new in this argument; but it does not grow weaker by age. And the case of Eginhard is far more instructive than that of Augustine, because the former has so very frankly, though incidentally, revealed to us, not only his own mental and moral habits, but those of the people about him.

† See 1 Cor. xii, 10–28; 2 Cor. vi, 12; Rom. xv, 19.

It may mean much or little. Paul nowhere tells us what he did in this direction, and, in his sore need to justify his assumption of apostleship against the sneers of his enemies, it is hardly likely that, if he had any very striking cases to bring forward, he would have neglected evidence so well calculated to put them to shame.

And, without the slightest impeachment of Paul's veracity, we must further remember that his strongly marked mental characteristics, displayed in unmistakable fashion in these Epistles, are anything but those which would justify us in regarding him as a critical witness respecting matters of fact, or as a trustworthy interpreter of their significance. When a man testifies to a miracle, he not only states a fact, but he adds an interpretation of the fact. We may admit his evidence as to the former, and yet think his opinion as to the latter worthless. If Eginhard's calm and objective narrative of the historical events of his time is no guarantee for the soundness of his judgment where the supernatural is concerned, the fervid rhetoric of the Apostle of the Gentiles, his absolute confidence in the "inner light," and the extraordinary conceptions of the nature and requirements of logical proof which he betrays in page after page of his Epistles, afford still less security.

There is a comparatively modern man who shared to the full Paul's trust in the "inner light," and who, though widely different from the fiery evangelist of Tarsus in various obvious particulars, yet, if I am not mistaken, shares his deepest characteristics. I speak of George Fox, who separated himself from the current Protestantism of England in the seventeenth century as Paul separated himself from the Judaism of the first century, at the bidding of the "inner light"—who went through persecutions as serious as those which Paul enumerates, who was beaten, stoned, cast out for dead, imprisoned nine times, sometimes for long periods, in perils on land and perils at sea. George Fox was an even more widely traveled missionary, and his success in founding congregations, and his energy in visiting them, not merely in Great Britain and Ireland and the West India Islands, but on the continent of Europe and that of North America, was no less remarkable. A few years after Fox began to preach there were reckoned to be a thousand Friends in prison in the various jails of England; at his death, less than fifty years after the foundation of the sect, there were seventy thousand of them in the United Kingdom. The cheerfulness with which these people —women as well as men—underwent martyrdom in this country and in the New England States is one of the most remarkable facts in the history of religion.

No one who reads the voluminous autobiography of "Honest George" can doubt the man's utter truthfulness; and though, in

his multitudinous letters, he but rarely rises far above the incoherent commonplaces of a street preacher, there can be no question of his power as a speaker, nor any doubt as to the dignity and attractiveness of his personality, or of his possession of a large amount of practical good sense and governing faculty.

But that George Fox had full faith in his own powers as a miracle-worker, the following passage of his autobiography (to which others might be added) demonstrates:

> Now after I was set at liberty from Nottingham gaol (where I had been kept prisoner a pretty long time) I traveled as before, in the work of the Lord. And coming to Mansfield Woodhouse, there was a distracted woman under a doctor's hand, with her hair let loose all about her ears; and he was about to let her blood, she being first bound, and many people being about her, holding her by violence; but he could get no blood from her. And I desired them to unbind her and let her alone; for they could not touch the spirit in her by which she was tormented. So they did unbind her, and I was moved to speak to her, and in the name of the Lord to bid her be quiet and still. And she was so. And the Lord's power settled her mind and she mended; and afterwards received the truth and continued in it to her death. And the Lord's name was honoured; to whom the glory of all his works belongs. Many great and wonderful things were wrought by the heavenly power in those days. For the Lord made bare his omnipotent arm and manifested his power to the astonishment of many; by the healing virtue whereof many have been delivered from great infirmities, and the devils were made subject through his name: of which particular instances might be given beyond what this unbelieving age is able to receive or bear.*

It needs no long study of Fox's writings, however, to arrive at the conviction that the distinction between subjective and objective verities had not the same place in his mind as it has in that of ordinary mortals. When an ordinary person would say "I thought so and so," or "I made up my mind to do so and so," George Fox says "it was opened to me," or "at the command of God I did so and so." "Then at the command of God on the ninth day of the seventh month 1643 [Fox being just nineteen] I left my relations and brake off all familiarity or friendship with young or old." "About the beginning of the year 1647 I was moved of the Lord to go into Darbyshire." Fox hears voices and he sees visions, some of which he brings before the reader with apocalyptic power in simple and strong English, alike untutored and undefiled, of which, like John Bunyan, his contemporary, he was a master.

"And one morning, as I was sitting by the fire, a great cloud came over me and a temptation beset me; and I sate still. And it was said, *All things come by Nature.* And the elements and stars came over me; so that I was in a manner quite clouded

* "A Journal or Historical Account of the Life, Travels, Sufferings, and Christian Experiences, etc., of George Fox," ed. i, 1694, pp. 27, 28.

with it. . . . And, as I sate still under it, and let it alone, a living hope arose in me, and a true voice arose in me which said, *There is a living God who made all things.* And immediately the cloud and the temptation vanished away, and life rose over it all, and my heart was glad and I praised the Living God" (p. 13).

If George Fox could speak as he proves in this and some other passages he could write, his astounding influence on the contemporaries of Milton and of Cromwell is no mystery. But this modern reproduction of the ancient prophet, with his "Thus saith the Lord," "This is the work of the Lord," steeped in supernaturalism and glorying in blind faith, is the mental antipodes of the philosopher, founded in naturalism and a fanatic for evidence, to whom these affirmations inevitably suggest the previous question: "How do you know that the Lord saith it?" "How do you know that the Lord doeth it?" and who is compelled to demand that rational ground for belief without which, to the man of science, assent is merely an immoral pretense.

And it is this rational ground of belief which the writers of the Gospels, no less than Paul, and Eginhard, and Fox, so little dream of offering that they would regard the demand for it as a kind of blasphemy.—*Nineteenth Century.*

MUSEUMS OF HOUSEHOLD PRODUCTS.

By RUDOLF VIRCHOW.

THE publication of a plan for establishing, in the capital of the German Empire, a "Museum of Popular Costumes and Products of Home Industry," has aroused so earnest and general an interest that the realization of the thought may be regarded as assured. It may, it is true, be possible to carry it out at first only to a very limited extent, for neither sufficient means nor space can be secured at once for setting up a comprehensive institution. But the initial purpose of the authors of the enterprise will have been accomplished when they have exhibited a series of objects illustrative of their plan. They confidently hope that these examples will satisfy their fellow-citizens of the usefulness and even the need of such a museum; and that the Government will assist it as it has assisted the technical museum, and will eventually take it under official care.

Herr von Gossler, the Prussian Minister of Worship, has already given the costume museum free temporary quarters in the old Industrial Academy, the present Hygienic Institute, in the Kloster-Strasse. The first acquisitions, which were made in the peninsula of Monkgut, in Rügen, satified him that profitable re-

sults could be secured. It is obvious that the acquisitions can be more easily made through private persons who are in more immediate intercourse with the inhabitants of the special districts, than through state officers, who will be hampered by numerous reserves. It seems clear, therefore, that the best course for the immediate present will be to excite interest in the enterprise among the people themselves; and to secure the participation of friends of the scheme in the practical support of its promoters. The development of the older museums has been predominantly to the advantage of the representative arts. Even architecture has been crowded into the background after sculpture and painting. Industrial art has been very slowly and tardily recovered from oblivion. Those highest efforts of human skill, while they arouse the admiration of the observer, vitalize and elevate the understanding, excite it to imitation, and give direction to the activity of whole generations. They have thus become pre-eminently the criterion of civilization.

But civilization has never anywhere come up at once. Many generations have to apply their best force, through slow labor, to gain artistic skill and make it at home. A kind of hereditary transmission assures the continuance of progress in this field, and in case of long interruption the recovery of aims and methods once possessed. Not only, therefore, does the investigator, the real art-expert, give his attention to the study of the history of art, but the question also occurs to the simple man of the people —who may have made such a great discovery, and how, in the course of time, ever higher degrees of skill and understanding in art are mastered.

Two circumstances have hitherto given deep significance to these questions, and extended them far over the domain of pure art: First, the increasing knowledge of the efforts of savages. This began with the great discoveries of the fifteenth and sixteenth centuries, but only obtained that fruitful significance in the general view which is now apparent to all with the scientific expeditions of the last century, especially with Cook's voyages and Alexander von Humboldt's researches. Who does not know that the course of civilization from its rudest beginnings to an often surprising height, lies visible as in an open book in the savages of to-day, and that the development of society, law, and religions, as well as the ordering of the household and the whole theory of property in household goods and ornaments, domestic animals and useful plants, may be observed, now here, now there, in their gradual building up? Unhappily, the savages are disappearing with fearful rapidity under contact with civilized races; and it may be considered fortunate that the increased care in the observation and collection of the things peculiar to these perishing sur-

vivals of primitive times is exerted in preserving the objects themselves as well as the recollection of them, for future study. Thus are explained the origin and growth of ethnological museums, of which the one in Berlin is one of the best specimens.

The second circumstance that has determined with hardly less force the direction of late research is the shaping of archæology into a real science of prehistory. The growing interest in the European states in collecting the antiquities of the country, with the activity of Danish and Swedish students and the co-operation of several German investigators, have been the means of introducing general order and chronological consistency into this previously chaotic domain. The discovery of the Swiss pile-dwellings kindled zeal in the study through all Europe; and prehistoric museums are now among the institutions in the completeness of which each nation has a peculiar pride.

In this study, out of the graves and dwellings of our ancestors, is unfolding before us a new picture of the growth of human civilization; and we observe with surprise and wonder how it serves as a complement to the conception supplied by the view of the development of savages, so that one supplements the other. We look at our ancestors themselves as they stood in their day where savages are now.

Art-history proper is preceded by the history of labor; a long story, that began in the farthest primeval time, is still continuing, and is destined to continue ever. There is no boundary-line between the two, for no man can say where art begins, or toil for daily living ends. Art proceeds out of the labor of the day, as a flower from a bud. History and prehistory are only outwardly separate, while inwardly they are undistinguishable. As prehistory survives in the present savages, so likewise prehistoric traditions pass over into the lives of civilized peoples. The recovery and preservation of these traditions is a not less important aid to the understanding of civilization than prehistory itself; for they furnish the threads by which we can trace the connection of the past and the present in immediate sequence.

The connections of the oldest traditions are afforded first by language and legends, for the study of which no museums are required. Next to these in value are material objects, particularly useful ones, with which are associated antique designs and mythic—sometimes superstitious—meanings, and which also in their forms, decorations, and applications give very definite views of their age. It is the purpose of the projected museum of costumes and household goods to collect these objects—not the only purpose, for there are many stages in the historical development of peoples which have left their traces in dress and furnishings, but the principal one. A museum of costumes and household

goods will, therefore, close the gaps between ethnological and prehistoric museums on the one side and between ethnological and historical museums on the other side. It will do for our own people what ethnological museums have done in relation to foreign peoples, particularly to savages; it will seek out objects of the present as historical museums have recovered them from the tombs and dwelling-places of primitive times; and will give for the common life and conduct of the peoples what historical museums have furnished as to their ecclesiastical and courtly life.

We have a right, therefore, to expect much from the museum of costumes and household goods. Experience has contradicted the objection that it is too late to carry out such a purpose. Our beginnings have already taught us that even in Germany one has only to inquire and exert himself earnestly to obtain a great number of objects of antique tradition. In other countries brilliant success has been achieved, especially in Sweden, which, through the indefatigable industry of Herr Hazelius, has had a model museum of this kind in Stockholm for many years. There are also notable collections of similar character in Moscow and Amsterdam; but the expectations should not be raised too high. Thus it is evident that what we perhaps too ambitiously call national costumes do not reach back into prehistoric times. There was then nothing like them. Such characteristic styles can exist only among those peoples of whom some of the tribes have continued in a kind of natural condition, and these are found in Europe only among those of the Finnish stock. With all the Aryan peoples of Europe the national costume is a relatively late, almost a modern, product. In Germany such costumes can be found only in limited districts, sometimes only in particular villages, and are seldom of earlier origin than the fifteenth century. Not a few of them were first fixed by the Reformation. The actual collection of the material may open the way to comparative studies that will furnish earlier dates, but this is likely to be the case only as applies to single parts of the dress.

Men are more permanent in their house construction, methods of tillage and of domesticating animals, in their furnishings and tools, than in their dress. Articles of stone, bone, horn, and clay, in particular, incline to be fixed in character. The groundwork of house arrangement persists through all the additions which the extension of the scale and the larger estate may entail; and it is, in respect to the family, as permanent as are the topography and flora to whole districts.

Whole houses can hardly be brought into museums except as they may be represented by models or drawings. Consideration will be given to these. Rooms and chambers may be introduced in complete arrangement, and we hope at the opening of the

museum to make such exhibitions of apartments from various stations, by means of which we shall be able to convey ideas of the more important parts of the house.

The new enterprise invites the active co-operation of our countrymen. As a rule, the people know best where such treasures as we desire to bring to light are to be found. We therefore ask them to help us gather up such national relics as still exist in the way of dress and house furnishings to be preserved for the observation of posterity.—*Translated for the Popular Science Monthly from Die Gartenlaube.*

THE WASTES OF MODERN CIVILIZATION.

By FELIX L. OSWALD, M.D.

II.

THE use of certain remedial drugs is apt to become a confirmed habit, which often continues to afflict the patient for years after his apparent recovery from the effects of the original disease. The medication of desperate moral disorders has now and then entailed a similar penalty. During the millennium of mediæval superstition, when the enforcement of antinatural dogmas had made common sense a capital crime and secular science an article of contraband, the study of classic literature became for thousands a refuge from the peril of madness. From the tyranny of the monkish Inquisition thousands of persecuted thinkers could still escape to the haunts of Plato and Virgil, as, in spite of chains and guards, a Siberian exile may in dreams return to the lost paradise of freedom. Knowledge, too, could still be delved from the treasure-mine of pagan philosophy, and for nearly a thousand years the study of dead languages became thus a chief condition of intellectual survival.

Intellectual progress had been almost completely arrested. Like a monstrous dam, the barrier of an unnatural dogma obstructed the currents of civilization; all through priest-ridden Europe the rivers of national life had been collected into a vast theological mill-pond, and only from the heights of a classical education, from turrets accessible only by steep and tortuous stairs, philosophers could, in retrospect, study the phenomena of life under less abnormal conditions, and naturally made the attic of that edifice the repository of their own choicest thought.

Then came the great dam-burst of the Protestant revolt. The rills of the first breach soon became uncontrollable torrents, and the flood of the accumulated waters rushed onward with an impetus which, in the rapid progress of science and reform, promised

to compensate the stagnation of a thousand years. Thus far, however, the speed of that progress has been sadly retarded by the very means which once constituted its only hope of revival. Instead of navigating the river of the new era in manageable boats, scholars persisted in clinging to the wreck of their classic observatory, to a cumbersome raft of old beams and planks which got stranded at every turn of the stream, and often became a serious obstacle in the channels of reform. The experience of the last three hundred years has as yet failed to disassociate the ideas of Latin and Greek from the scholastic notions of culture, and the time may come when practical educators will almost fail to realize the possibility of the fact that, in our own rapid age of discovery and invention, millions of our most gifted students had to waste from one-third to three-fifths of their time on the study of dead languages. Witness the following curriculum of the German *Gymnasia*, or high schools—the preparatory colleges of the best European universities, and the gates to every highway of liberal education:

Latin, ten hours per week; Greek, eight hours; Hebrew, three hours; German, four hours; mathematics, four hours; geography, two; history, two; drawing, two; French, two; physiology, two; religion, optional; English, optional (occasionally taught instead of French); gymnastics, four hours. In other words, twenty-one hours of graveyard studies to eighteen hours of all living sciences taken together, since gymnastics has ceased under certain circumstances to be a compulsory branch of education.

Those twenty-one hours devoted to the dead leave not a minute's time for the study of such problems of life as biology and rational hygiene; not a minute for anatomy, political economy, philosophy, rhetoric, or non-sectarian ethics. Such things, of course, are taught by the regular or special professors of the university; but a large percentage of students pass directly from the primer-class of the gymnasium to the duties of practical life, and in ninety-nine of a hundred cases may charge the long period given to the study of the ancient languages to the budget of total loss. Not one of a hundred non-philological students (graduates devoting themselves to the special study and the teaching of ancient languages) would ever dream of continuing his antiquarian pursuits or be able to look upon a Greek or Latin textbook without a shudder of disgust. It has been conclusively proved that all the etymological benefit derived from linguistic graveyards could be reaped in a single year by the study of root-words (most of them familiarized by their French and English derivatives). It has been demonstrated to the satisfaction of every impartial thinker that grammar-drill is *not* the superlative

intellectual exercise vaunted in the arguments of its advocates, but, on the contrary, almost the worst of all possible systems of mental training—a dead-lift of memory, exercising the lower at the expense of the higher mental faculties. Nor is there a shadow of a doubt that in natural history, astronomy, geography, physiology, and mathematics, the achievements of Greece and Rome have been distanced as far as their own writers eclipsed the wiseacres of Scythia and Abyssinia. Yet the New World continues to emulate the Old in wooing the specters of the past, and thousands of American parents encumber the memory of their children with a mass of antiquarian rubbish that leaves no room for the culture of progressive science, too often not even for the adequate study of their own mother-tongue.

A cardinal tenet of mediæval ethics was the belief in the merit of *mental prostitution*—the duty of submitting to dogmas which their professors did not and could not believe, and which the exigencies of daily life obliged them practically to repudiate.

A logical consequence of that doctrine was the antagonism of theory and practice, which continues to involve an enormous waste in our method of moral education. A million pulpits still preach a gospel that inculcates the vanity of industrial pursuits. "Take no thought of the morrow, for the morrow shall take thought for the things of itself." "Take no thought, saying, What shall we eat, or what shall we drink, or wherewithal shall we be clothed? For after all these do the Gentiles seek." As a practical comment on the wisdom of those precepts, nations, cities, and corporations vie in the restless pursuit of wealth, and a thousand lessons of daily life admonish the young citizen of our industrial world to take earnest and constant thought of the morrow; nay, the mere attempt to disregard those lessons would be followed by the punishment of the shiftless vagrant.

Loss of health and wealth, loss of working capacity—in fact, every form of temporal affliction—the disciples of our moral exemplar are instructed to consider as proofs of divine favor. Yet the prevention of such favors is the legally encouraged purpose of dozens of fire and life insurance companies and mutual aid associations with their omnipresent agencies.

Our ethical text-books in the plainest terms teach the possibility of curing diseases by prayer and mystic ceremonies. "If any man is sick among you, let him call for the elders of the church and let them pray over him, anointing him with oil in the name of the Lord." "And the prayer of faith shall save the sick, and the Lord shall raise him up." "And when he had called unto him his twelve disciples, he gave them power against unclean spirits, to cast them out and to heal all manner of disease." Yet in at least forty-five of the fifty most civilized countries of Chris-

tendom the attempt to cure any serious disease on that plan would be followed by a prompt indictment for quackery.

The possibility of diabolical apparitions is implied in a countless number of passages which our traditional creed requires us to accept as infallible truth. Devils by scores and legions range the land of faith, tempting the virtuous, afflicting men and animals with strange diseases, or even taking permanent possession of a human body still tenanted by a conscious soul. The report of a five minutes' interview with the smallest of those imps would now expose the narrator to the risk of a lunacy inquest.

The worthlessness of earthly life is inculcated with a distinctness which seems intended as an encouragement to the indirect suicide of monastic asceticism; yet the same moralists who bewail this earth as a vale of tears take the liveliest interest in the prolongation of human life, and court popularity by indorsing every measure tending to promote the progress of sanitary reform.

The inevitable result of such inconsistencies is a moral confusion resembling the bewilderment of the guests invited to the banquet of Rueckert's Hakim Baba, who urged his visitors to indulge in wine, but thrashed them fearfully if they showed any signs of intoxication.

From the chaos of conflicting theoretical and practical lessons our children, by the aid of experience, somehow manage to evolve a moral compromise code of their own; but what a waste of time could be saved, how many hours of doubt, perplexity, and repentance could be obviated by a system of ethics inculcating precepts in harmony with the laws of nature and the facts of actual life!

Yet the injury caused by the theoretical survival of obsolete dogmas is far surpassed by the baneful results of the attempt to reestablish their authority by the aid of legal enforcements. Moral confusion in that case takes the more serious form of a moral revolt which strikes at the very root of social order by making injustice a synonym of law and order. The statesmen who constantly warn us against the danger of attempting social reforms by an appeal to "paternal legislation" have as yet failed to explain by what right they continue to employ that method for the perpetuation of social abuses. They decline to meddle with the affairs of their poor brother, for fear of sheltering him against "the natural penalties of his shiftlessness"; but they risk that interference by enforcing laws to deprive him of the natural rewards of his labor, especially if their own position enables them to evade the inconveniences of such laws. In other words, they denounce meddlesome help but connive at meddlesome injury. Their tender conscience shrinks from the injustice of confessing an arbitrary, unearned blessing, but consents to the injustice of inflicting an arbitrary, undeserved curse.

For what else is the tyranny of the laws by which nine tenths of our fellow-citizens are robbed of their scant chance of recreation and obliged at the expense of their mental and physical health to toil like criminals, whose only alternative of labor is the dreary inactivity of their prison-cells—all in order to retain a conventional mark of deference to the joy-hating insanity of the middle ages—or, perhaps, to enhance by the charm of contrast the prerogatives of the privileged few, whose abundance of leisure days enables them to dispense with the blessing of a free Sunday?

It is true that the rigor of mediæval ethics has been modified in several important respects. The duty of abstaining from work and relying on prayer has been abrogated in favor of our tax-paying national industries. The duty of despising the danger of defilement by things that enter the mouth has been generally remitted in favor of candidates for the temperance vote. The obligation of despising the vanities of secular science does not prevent the Rev. Tollemach-Tollemach from collecting his tithes by telephone; but the duty of renunciation, of submissive abstinence from worldly and physical enjoyments, is still enforced at the expense of every laborer whose financial circumstances preclude the luxury of extra-Sabbatarian leisure days.

In the course of the last twenty years several hundred appeals for the abrogation of our anachronistic blue laws have been calmly ignored as below the notice of legislators engaged in such important reforms as the dredging of Catfish Bayou, though it might be questioned if the total amount of misery entailed on our workingmen by the systematic suppression of public recreation has ever been surpassed by the results of the most inhuman alliance of mediæval bigotry and despotism. The Spanish Inquisition enforced its mandates regardless alike of fear and pity; but its victims were selected from a class forming, after all, only a small fraction of the total population—one scapegoat, perhaps, in a herd of ten thousand—while at least a hundred-fold proportion of our countrymen feel the galling yoke of the Sabbath despots. The Scotch ascetics of David Hume's time filled their churches by a system of penal statutes which made financial and social ruin almost the only alternative of conformity; but the Caledonian peasant who had passed a week among the flocks of his Highland home might easily endure a day of confinement in the man-pen of his kirk, while the bigots of our manufacturing communities enforce their asceticism upon men who need recreation and outdoor sports as they need food and sunlight, and whose numbers include thousands for whom the promise of a *post-mortem* Utopia has lost its compensating value.

A few Sundays ago I accompanied a friend on a stroll across a

hill-pasture where a young goat-herd lay stretched out at full length under a tree still dripping from the showers of a recent thunder-storm.

"Hallo, Billy!" called out my companion. "What are you doing in that puddle of rain? Don't you know there is a law against bathing on Sunday?"

"That's a fact," laughed Billy. "If a stretch in the wet grass could do a fellow any good, I have no doubt there would be a law against it."

That reply exactly defines the popular verdict on a code of laws founded upon a system whose corner-stone is indeed the dogma that "whatever is natural is wrong." Sabbatarian despotism has succeeded in connecting the popular notion of a moralist with the idea of a kill-joy, and made religion a synonym of a system for the infliction of the greatest possible misery on the greatest possible number.

"Why, but is there not an offset in the leisure gained for the perusal of moral and instructive pamphlets?" asks the agent of the Free Tract Society.

Our pious friends can, indeed, not be accused of underrating the value of those tracts if they expect them to compensate the waste of opportunities for life-brightening recreations, the loss of good humor, the loss of patriotism, the loss of faith in the benefits of laws and creeds, the loss of content, and the often irretrievable loss of health and vital energy.

THE ETHICAL VIEW OF PROTECTION.

A WORD TO THE WAYFARING MAN.

By HUNTINGTON SMITH.

WHENEVER any great question comes up for settlement, there are always people ready with arguments on both sides. These arguments are all supported by what we call facts. Facts in great numbers are accumulated to prove diametrically opposite things; for there is no question, it matters not how absurd it may be, that facts in abundance can not be found in its favor. Now the simple truth is, that facts mean nothing till we know the relation which they bear to other facts. A mass of facts is like a heap of bricks; and just as you can construct any sort of a building out of a given heap of bricks, so out of a sufficient number of facts you can, by picking your material and fitting it together in accordance with some plan you have already determined upon, build up any sort of an argument. There is a common saying that figures will not lie. It is true that figures do not

of themselves lie, any more than a heap of bricks will lie; but they can be made to lie, just as a heap of bricks may be used for the construction of a sham building. We may compare the discussion over a great question to the terminal moraine of a glacier. The word *moraine* means a heap of rubbish. When a glacier is formed and begins to push its way down a valley, a vast mass of rubbish gathers and conceals its approach from view. If you did not look carefully at one of these terminal moraines, you never would know that there was any glacier; and after you discovered the glacier you never would know, except by careful observation, that it moved. Yet it does move, slowly but surely, in spite of the rubbish that seems to block its way. The rubbish is pushed on little by little, and in due time the glacier gets to the sea. Every one realizes then that the important thing was not the moraine but the glacier. The moraine has been ground out of sight or is scattered along the path; but the glacier remains.

So it is with every great truth that is making its way in the world. It stirs up a vast amount of talk. Some people approve of the truth, and bring their little store of facts to show what a fine thing it will be; others disapprove of it, and bring the same little facts, arranged in a different way, to show that if this principle is adopted it will inflict immense damage upon the welfare of society. Many remember how it was when the great question of the abolition of slavery came up in this country. Some men argued against it, ingeniously devising plausible arguments, full of statistics and Bible texts, and assertions that slavery was indorsed by Christianity; and others argued in its favor, with more statistics, and other Bible texts, and the assertion that Christianity and slavery were totally incompatible; and meanwhile the principle of human freedom went on working, and in time the slaves were set free.

How did the man of upright mind and noble heart decide the question of slavery or abolition in the days when that question was before the country? Did he weigh argument against argument, statistics against statistics, this Bible text against that Bible text? No. He simply sat down in the quietude of his own chamber and said to himself: "The slaves are men like me. Would I be willing to be a slave? Will it, in the long run, be profitable to humanity if a portion of the human race remains in bondage?" And it did not take him long to answer the question. His own reason told him what the answer was. He declared then and there that slavery was wrong, and henceforth he was on the side of freedom.

Now, a man who takes such a course as that, it matters not how learned or how ignorant he may be in the science of facts, is a philosopher. A philosopher is a lover of wisdom, and it is pos-

sible to be wise and yet to know very few facts. Wisdom does not consist in the ability to heap up facts, although our school instructors seem to think it does. Wisdom is concerned with something far higher than facts; it is concerned with the true, the eternal, the unchanging relations of things. The man who has grasped a few of the elementary truths of existence and governs his life in accordance with them is wise, even if he can not read a line of Latin, or solve a problem in algebra, or work out a sum in the rule of three. A few of the elementary truths of existence are that you must treat others as you would be treated yourself; that, if you would derive the utmost possible advantage from your relations with your fellows, you must be frank and open in what you do; that you must not build up barriers of restrictions between yourself and others and expect to thrive, either materially or morally, as you would if the barriers did not exist—in a word, the elemental truths of existence upon which we must depend are justice, fraternity, and love. The man who governs his life by these principles may not be a learned man; he may not be able to construct ingenious arguments from census reports; but he will be a good father, a kind neighbor, a man you can trust in business, and he is pretty sure to be prosperous, because he is on the side of truth and righteousness, and somehow or other truth and righteousness, sooner or later, always win.

The great questions, as we have said, are all the time arising, and they have to be met in some way. Each generation has its own particular question to settle. In this country, a generation ago, it was the abolition of slavery. That question was effectually settled, as we all know. Now a new generation has come upon the stage, and a new question arises. The new question is broader than the other, although it does not go so deep. If it does not affect so closely the very principle of manhood or call for such heroic treatment, its settlement concerns the welfare of a far greater number, and upon it depend the prosperity and happiness of the whole nation. It is not, then, a question to be decided lightly. Every man should think long and carefully before rendering his decision. The question with which we are now concerned is that of protection and free trade.

Here, as in all other great questions, we find men taking sides and trying to win converts to their own special views by arguments in which statistics—that is, facts—in one form or another, are brought together to prove diametrically opposite things. If we listen to them, we are perplexed, we are not enlightened. If one man tells us that wages are higher in this country because of protection, and that consequently everybody is better off with protection than without it; and another man tells us that, while wages will be lower under free trade, the expenses of living will

be far less, and, being relieved from the burden of heavy taxation, we shall all be much more prosperous than we are now; and if each of these men supports his assertions with a vast array of incontrovertible statistics, what are we to do—we who are not learned in figures, or who see that the same facts differently arranged can be made to prove different things?

Evidently there is only one course open to us if we wish to decide the question on its merits and not in accordance with personal prejudice, or party affiliation, or the superior eloquence and ingenuity of the orator we hear last. We must brush aside all these confusing statistics, ignore the arguments based upon them, and put the matter before our minds in the simplest form. We must deal, not with a misleading array of facts, but with the elemental truths of existence. We must do this, even though we run the risk of being called mere theorists and impractical. The trouble with the practical man is, that his vision is closely limited; he sees only what is directly under his nose. The practical man always wants to get change for his dollar as quickly as possible. He is never willing to run what he calls risks—that is, he is never desirous of making a beginning till he has the end within his grasp. It was not a practical man who built the first steamship to cross the Atlantic, or invented the electric telegraph, or planned the first ocean cable, or conceived the idea of the Pacific Railway. The relation of the practical man to humanity in general is the same as that of the hands to the body. It is not for the hands to make plans or say how things shall be done; that must be left to the brain. It is the business of the hands, when the plan is made, to take hold and do the work. And just as the hands can not judge of a thing simply by the sense of touch—can not tell a five-dollar gold-piece from a copper cent—so the practical man, because governed by immediate appearances, is of all men the most easily deceived.

But you, if you are a theorist, a philosopher, a man who deals with general principles, will settle the matter for yourself in accordance with general principles. If the question before you is that of free trade and protection, and practical men are being confused and misled by the artful devices of statistical orators, you will simply refuse to listen to the conflicting statements of either side, which do not prove anything, and never can prove anything. You will decide the matter for yourself on general principles; and you will first wish to determine clearly and definitely what is meant by the terms protection and free trade.

The word protection means a defense, a guard, literally a cover or shield against something or somebody, and it can be used, of course, only against an enemy. No one would think of protecting himself against a friendly influence. The word protection, or its

equivalents in different languages, was devised by man when he was still in a barbarous condition, when his hand was against every other man, and every other man's hand was against him. It was necessary that he should have some sort of a defense or cover to enable him to attack his enemies without being immediately killed, and this defense or cover, whether it was a shield to hold before his person or a strong wall built about his dwelling-place, he called a protection. Holding the shield before him, he could throw his spear or shoot his arrows at his enemy and not be harmed by the spear or the arrows his enemy returned; behind the strong wall he could be safe from assault and carry on the various activities of life without fear of molestation. He could, if he chose, scour the surrounding region, and rob and kill right and left, and get back to his strong wall before those he attacked could rally and take him prisoner. The outside barbarians would not endure this sort of thing forever. They also longed for protection. They got shields for themselves and built strong walls about their places of refuge, and in this way groups of what we now call society were first organized. Each of these groups was a very barbarous sort of society, but it was society nevertheless. A society means an association of persons for mutual profit or advantage. The barbarous group was a society based on protection, and protection was therefore an invention of barbarism; it was armed and organized selfishness; it was the means by which theft and rapine and murder were made possible on a large scale.

Time went on, and man gradually acquired better ideas of living. The little protected groups who were continually making war on each other and trying to prosper, each at the advantage of the other's happiness and prosperity, were led to see that they would be happier and more prosperous if they would stop making war on each other, tear down their strong walls, and unite in one harmonious community. It is not known who the first man was that conceived this idea, but whoever he may have been he was unquestionably a great benefactor to the human race. The groups that united into communities, however, did not embrace the whole of mankind. In fact, in these first days of primitive intelligence, a single community in which all mankind could unite was out of the question. A good many groups were still so barbarous that they preferred a hazardous existence maintained by war, rather than the prosperity that was sure to follow a friendly cultivation of the arts of peace. The groups that did join into communities were closely related to one another by blood; they spoke the same or nearly the same language; they had the same or similar customs, and their ideas of what life was for were nearly identical. These groups united and formed larger

groups or communities, and then the same relation existed between the large communities that had hitherto existed between the smaller groups. They all felt the need of protection, and this desire for protection led them to build larger and stronger walls, and to devise new methods of defense.

The only advantage was—and it was a great one—that, instead of a lot of little groups all fighting with one another, there were now large communities, and the chances for fighting were correspondingly decreased. But the process of assimilation once begun could not stop, because man, if he was to be anything more than a fighting animal, must agree to live on friendly terms with his fellows and cultivate the arts of peace. The process went on: communities that had gradually grown to have similar ideas united into still larger communities; tribes became states, and then, at last, states became nations.

Now the idea of the necessity for protection has so long been dominant with the various associations of men that these associations, even in our days of general enlightenment, do not readily believe that it can be given up. A man who has been living for years in a wild country where he has been liable to attacks from savages at any moment, does not readily adapt himself to the new conditions of mutual trust when he comes to live again among civilized and peaceful folks. You will find him still sleeping with his revolver at his side, and when he walks abroad he has his eye out for a possible ambush. So it is with the associations of mankind that have developed from the far-back barbarous groups. They know that the conditions of existence have changed, they know that if they are peaceable and industrious they will not be molested; but the idea of protection still lurks in their minds, and they feel that they must have it in some form, or be at the mercy of the rest of mankind, whom they wrongfully regard as enemies, but who are by nature as peacefully inclined as themselves.

And so we find man, as intelligent and enlightened as he is today, still clinging to this relic of barbarism, this system of organized selfishness known as protection. The trade of man is no longer fighting, the trade of man is now to devise inventions for his own comfort, and although we find some great associations maintaining vast standing armies in conformity with the spirit of protection, the chief occupation of man is with the arts of peace. The arts of peace and warfare are incompatible; one builds up and the other tears down; one creates, the other destroys; hence it is generally acknowledged that warfare is an evil which must soon be abolished. Men can not fight and at the same time till the fields, work in factories, construct railways, write novels, preach sermons, and paint pictures. Men are beginning to see now that

fighting is a foolish waste of blood and time and money, especially money, and before long fighting will be abandoned, because when men once are thoroughly convinced that a thing is foolish, or that it costs more than it comes to, they stop doing it. The few men who are now in favor of war are practical men who believe that war conduces in some way to national prosperity or helps trade. They would like to see things torn down, if they could have the opportunity of building them up. The theorists, the philosophers, are all opposed to war; they know it does a great deal more harm than good.

War, then, which has so long been the chief form of protection adopted by nations, is doomed. Men began some time ago, when peaceful communities were fully established, to see that it was doomed; but the old idea of protection, growing out of the distrust of humanity for humanity, had its hold upon them, and they set themselves at work to devise some new method of protection which would meet the new conditions and not destroy what we may call the industrial type of society. The practical men of the day put their heads together and said that the chief thing now was trade, and that they must not permit any rivalry in trade. The enemies of their special community were no longer the men who were better armed or better fortified; the enemies of their community were the men who could make things they could not make, or supply things they could make at a lower price.

"Let us," they said, "keep trade to ourselves. Let us make everything we want, be sufficient to ourselves, and be independent of the rest of mankind. In that way we shall grow rich and prosperous, and the rest of mankind may supply its wants the best it can."

How were they to do this? The days of war were going by. They could not establish guards and shoot every one of their fellow-citizens who bought anything of a foreigner, or shoot every foreigner who brought goods to sell within their borders. They could not do this, because it would be ruinous and expensive, but they could fine every person who engaged in trade with any person outside their own nation, and this they proceeded to do. They established a new form of protection, and called it very properly a protective tariff. The word *tariff* comes, so some philologists tell us, from Tarifa, a town in Spain at the entrance of the Strait of Gibraltar, where passing vessels were detained by force and obliged to pay tribute to the inhabitants. The citizens of Tarifa were the first of the modern protectionists. When we speak of protection nowadays, we mean a system of tribute imposed upon a whole nation by a certain small but powerful class of its practical men. The system is so devised that it takes money out of the pockets of the people and puts it into the pockets of the practical

men, who are manufacturers and traders. At least, it does so at first. After a while it does something else, and the manufacturers and traders lose by it, just as the practical men of barbarous times lost in the end more than they gained by war.

We have now traced the idea of protection from the beginnings of human society down to the present time, and we know what it means. What, on the other hand, is free trade? The term free trade explains itself. It is the opposite of protection. It does not believe in barriers or covers or defenses. It does not believe in organized selfishness at the expense of the many for the good of the few. It believes in the most open and free intercourse between all mankind. It believes that all men are brethren, and that it is no more right to fine an Englishman, a German, or a Frenchman because he can do a thing well than it is to fine an American for employing an Englishman, a German, or a Frenchman to do a thing well. It believes that the world is large enough, the resources of nature sufficient, to enable every man to support himself without joining a protected community and forswearing the help of others. Protection, as we have seen, is organized selfishness. Free trade is based on the elemental principles of existence—on justice, fraternity, and love.

But now come the orators and tell us, on one side, that protection means higher wages and greater prosperity for everybody, and, on the other side, that free trade means reduced expenses for the necessities of life and diminished taxation; and the orators on both sides have countless statistics to prove the absolute truth of what they say. What are we, who are not practical men, and who know that statistics will prove anything—what are we to do? Evidently we must fall back on elemental principles, and extend our reasoning a little further. We must examine the assertions of the orators in the light of general principles, and ask whether they are true.

Let us suppose a primitive group modeled after the groups of barbarous times to be formed in our day in accordance with the existing industrial conditions. Let us suppose a family group—for such the early groups were—a family group consisting of a father, a mother, three daughters, and four sons. In the barbarous days families were sometimes of this size. The father, we will imagine, is a shoemaker; the mother a milliner; the first daughter, Sarah, a dressmaker; the second daughter, Jane, a cook; the third daughter, Mary, a seamstress; the first son, James, a tailor; the second son, Thomas, a hat-maker; the third son, John, a butcher; the fourth son, Henry, a grocer. Each has grown to be expert at his or her particular trade, and is doing well. But the third son, John, is a very practical man, and he has studied what is called political economy. Political economy

is the science of selecting suitable facts to prove certain predetermined propositions with regard to the laws of trade; it can always be made to favor protection, but it will also favor free trade if you choose to have it do so and select your facts with proper discretion; political economy is the favorite science of practical men. John, then, has studied political economy, and he comes to the conclusion that the various members of the family are squandering their forces by working for outsiders. He calls the family together and says:

"I think I see a way in which we could be more prosperous. We must give up working for the rest of the world. Father must make shoes only for us; Jane must not cook for anybody except ourselves; James must not make clothes for any one except his father and his three brothers; Henry must not undertake to sell groceries to people who do not belong to the family; and I shall not supply any one but you with meat. Moreover, no one must buy of other people. We must have our shoes made by father, our clothes by James, and we must buy our groceries of Henry. If any member of the family buys anything of an outsider, he is to be fined twenty-five per cent of the cost of the article; and if any one of us sells anything to an outsider, and takes that outsider's goods in exchange, those goods shall be taxed one fourth of their value. The money so collected shall be put into a common fund, and used for defraying the joint family expenses."

What, think you, would be the reply of the philosophic father to a proposition like that? He would not be likely to waste many words over the matter. He would tell John flatly that he was a fool, and advise him to let political economy alone, and he would send the whole family about their business.

But now let us suppose that, instead of a family, we have a town made up of a hundred families, and the people get together and are asked to adopt a proposition similar to that made by John, the political economist. Some prominent citizen arises and declares that the town would be vastly more prosperous and independent if all its trading were done within its own limits; that the poor and struggling traders would have enough to do if people would patronize them instead of sending to other towns for goods; and that, to discourage trade with outsiders it was expedient to tax all such commercial transactions, and place the money so obtained in the town treasury. Would not this proposition be as absurd as the other? Would not some citizen with a philosophical turn of mind, who reasoned from general principles, reply in words like these:

"The gentleman who has made this proposition is talking nonsense. The prosperity of this town and the comfort of its

inhabitants depend on its relations with other towns and the country at large. Our prosperity and comfort depend on the number and quality of things we can make that the rest of the world wants, and the facility with which we can exchange those things for things that we want. The gentleman who has just spoken proposes to tax the very relations upon which our material welfare is founded! We want corn and wheat and tea and coal and sugar; can we produce any of those things here? Certainly not. In order to get them we must make things wanted by the people who can and do produce corn, wheat, tea, coal, and sugar, and exchange our products for theirs. If we tax corn, wheat, tea, coal, and sugar, the people who want our goods will take them and pay for them in money, and we shall simply be paying out of our own pockets the extra valuation put upon goods that we want. We all of us who want and must have corn, wheat, tea, coal, and sugar, will be paying extra for them, and the only people who will be benefited will be the few among us who produce the articles that outsiders want. They can put larger prices on their goods on the strength of the extra valuation of corn, wheat, tea, coal, and sugar, and so the greater portion of the taxes will fall indirectly into their pockets. It will be cheaper for us in the end to pay the money directly over to them in the form of subsidies, which is a polite term for legalized charity."

Somewhat in this way, no doubt, the philosophical citizen would speak, and it would be strange if a majority of his fellow-citizens did not agree with him. If we enlarge our community, and instead of a city have a state, would the conditions be any different? Not at all. Certain people in this state would be able to do certain things well, and their prosperity would depend upon the facility with which they could exchange their labor or the products of their labor with the labor or the products of labor of the citizens of other states. What would have been the condition of this country, of the United States of America, if every State had put up a barrier against its neighbors in the shape of a protective tariff? Suppose that an inhabitant of Massachusetts could not get anything from Pennsylvania or New York without paying a duty, and suppose that an inhabitant of New York or Pennsylvania could not buy of an inhabitant of Illinois without being taxed by his own State from twenty-five to forty per cent on his purchase, what would become of our national prosperity? To ask the question is to answer it. The prosperity of each depends upon the utmost freedom of intercourse with all the others.

Let us now take a still wider outlook, and extend our reasoning a little further. Why, if a protective tariff is not conducive to prosperity when established between families or towns or

states of the same country, should it be regarded as beneficent to the welfare of a country when every country is only a state in the great federation of humanity we call the world? Do not the elemental principles of existence apply to countries as well as to states? They certainly do. Then whence the argument that a protective tariff between states of the same country is wrong, while between countries even of the same blood and race it is right and proper, and conducive to national prosperity? Is it not plain that the device of a protective tariff between countries is a relic of the old barbarous idea of protection, the idea that people belonging to other communities are enemies, and that we must have as little to do with them as possible, except to fight them if they trespass on our rights or threaten to take trade away from us? It must be so, or men who profess to believe in justice and fraternity and love between all mankind never would be found advocating the detestable and misleading system of organized selfishness built up of burdensome taxes upon the relations that alone can civilize, enlighten, and elevate the whole of humanity and so conduce immeasurably to the welfare of the whole world.

One of the chief arguments of the orators who favor protection is, that under the tariff system the prosperity of this country has been very great, and as usual they cite an endless array of statistics to prove the truth of what they say. But is the assertion reasonable? Can we who govern our ideas by common sense and not by the dictates of short-sighted expediency agree with the orators when they say that our national prosperity is due to protection? Do we not find, when we come to consider the matter, that through our boundless resources and unlimited energy in industrial affairs we have prospered in spite of the protective tariff, not because of it? If the State of Pennsylvania adopted a protective tariff and continued to prosper and heap up wealth within her borders, should we say that it was because of the tariff? No. We should see at once that her prosperity was due to causes superior to the disadvantages of a tariff system—that is, to the extraordinary capacity of her citizens for industrial affairs and the vast stores of material at their command, enabling them to conquer obstacles under which less powerful communities would languish or utterly perish. If a man sets up a bazaar for the sale of any sort of goods, and charges an admission fee to customers, and yet can sell his goods low enough to induce customers to pay the admission fee and enter and make purchases, and if this man amasses a great deal of money from his business, we shall not be likely to say that his riches are due to his system of admission fees. We simply conclude that he must have an extraordinary capacity for getting his goods at a low price; he

prospers, not on account of his system of admission fees, but in spite of it.

We have gone far enough now in our course of reasoning to see that in the light of the elemental principles of existence the evils of protection are very great. Its greatest evil is that it interferes with the free exchange of human activities; it puts a check upon justice, fraternity, and love. But a great evil can not exist without engendering other evils. Another evil engendered by the protective system is that it encourages poor and defective work. If a man is sure of plenty of trade, no matter how he makes his goods, he will not be so particular with regard to the quality. Ask an American oculist where he gets the delicate instruments with which he tests the eyes of his patients. He will tell you, if he is an expert at his profession, that he gets his instruments abroad. Why? Because the men in this country who produce such articles are not careful to do good work. They can make inferior instruments and sell them to the generality of oculists who are not expert, and make more money than they could by producing really excellent articles, and selling them at the same price as the foreign goods. If you buy a suit of cheap clothing in this country, the chances are that it will be of little service compared with a suit of clothes you could buy for a third less if you were living in London. Why? Because the tariff on woolens enables the American manufacturers of clothing to use cheaper and poorer goods, and to charge more for a suit of clothes than the foreign suit of first-class material would cost if you could send to London and buy it without being fined for patronizing an English tailor. As a matter of fact, a great many rich Americans who go abroad do patronize foreign tailors and do not get fined, but of course the poor Americans who have to stay at home and support the tariff system can not do this. They must buy poor clothing of their fellow-citizens and pay nearly as much for it as they would for a foreign article of excellent quality. American clothing manufacturers will tell you that they can make as good clothing as a foreigner can and at as low a price. Of course they can, but they don't. If they did, they would not be in favor of protection; they would be willing to meet the foreigner on terms of friendly competition, and not take advantage of him by skulking behind the tariff wall maintained at the expense of the people who do not make, but who buy, clothing.

Imagine a community isolated from the rest of the world, and that this community suffers from a water famine. All the wells have dried up, and water has to be brought from a distant river. Each person goes after what water he needs, or employs some one else to bring water for him, and every one is supplied. But a few

practical men get together and say: "How much better it would be if everybody went after water and poured what was brought into a common tank from which supplies could be drawn as needed! We will build the tank." They build the tank, and the people bring water and fill it. Then the practical men take possession of the spigots and charge the people so much a gallon for all the water drawn from the tank. The practical men are protected by the labor of the rest of the community; unfortunately, all can not be practical men.

Of course, the effect of protection upon the morals of the protected must in the end be very bad. It has a tendency to make them cowardly, treacherous, and grasping. The fear of meeting outsiders in friendly competition; the temptation to make poor goods when poor goods can be sold for an unjustly high price; the business of seizing as legitimate prey the labor of others and turning that labor to one's own uses—must, sooner or later, have a bad effect on the individual and the community at large. A man can not thrive at the expense of other men, whether those men are his near neighbors or are living at the antipodes, without being hardened in his sensibilities and becoming to a certain extent inhuman. The effect of protection upon the moral welfare of the protected is bad; its effect on their material welfare is eventually ruinous. In barbarous times, when men collected in protected groups behind strong walls, the outside barbarians had as little to do with them as possible. They removed their goods if they could beyond the reach of plunder. On the other hand, a great many practical men crowded into the fortified groups when the advantages of protection were recognized, there was soon not enough plunder to go round, and the practical men who believed in protection quarreled among themselves as to who should have the spoils, till they learned by experience how foolish fighting was, and joined a larger community where they could live on friendly terms with a larger number of their fellows. So it is with the protected in our day. As long as the wants of a protected community are simple and the industries with reference to the population few, the community gets on very well. If its resources are ample, it will be able to produce things at a low price and compete in the open markets of the world with the producers of older, unprotected communities which have no such natural resources to draw upon. But the time comes when the natural resources of the favored community are exhausted and it can no longer produce certain things at a lower price than anybody else. Then the members of other communities will not pay for the privilege of trading with a protected community on equal terms. They will go elsewhere with their products, where they can exchange them freely. An Englishman, who is a practical man

taught by the theorists and by hard experience that free trade pays in the long run better than protection, will buy of an American only as long as he can exchange his own goods, plus the duty exacted by the tariff, for the American's goods, and still get them lower than he can of anybody else. When the American can no longer sell the goods the Englishman wants at a lower price than that demanded by other people, the Englishman will go elsewhere; and if the American puts a tax on the Englishman's goods, it is the same as charging more for his own goods, and he is simply handicapping himself in what ought to be a free race.

When this happens—and it is sure to happen sooner or later, because if a man, however strong, willfully handicaps himself in a race, there is sure to be found in time a man who will beat him—when this happens the producers of a protected community have no longer any foreign demand to depend upon and the home demand is not enough to take up the supply, because so many practical men have been attracted into the protected community and gone to producing, that more things are made than the community really desires. The community desires things that its own members can not make, and to get them it must exchange money, which represents labor in some form, at a ruinous disadvantage. The result of all this is, that the practical men who have been producing things their own country does not want are deprived of patronage and are worse off than if they had never been protected. If the family of which we were speaking a little way back had been contented to live out in the country by themselves in a simple way, they would have got on very well without the rest of the world. They would have cut down trees and built a cabin, made a clearing and planted corn and potatoes, hunted game, clad themselves in the skins of animals, and existed entirely independent of their fellow-men. But their wants were numerous, they were forced to depend on others to supply them, and they were obliged to exchange the products of their own labor with the products of the labor of the rest of the world.

We could go on multiplying examples, but we might end by being statistical, and we must not forget the general principles which were to govern our decision. It is clear enough now that protection is a relic of barbarism; that it interferes with and often interrupts the interchange of human activities; that it is ruinous to justice, fraternity, and love; that just as protection in barbarous times, by means of strong walls and armor, put a premium on brute force and treachery, so protection in these days, by means of a commercial tariff, puts a premium on ignorance and fraud. For these reasons we know that the world would be better off without protection in any form, and we are bound

to do all we can to rid humanity of a burden so heavy to bear and so injurious, materially and morally, to every member of a civilized community.

"Gold and iron are good
To buy iron and gold;
All earth's fleece and food
For their like are sold.

. . . . . .

"Nor kind nor coinage buys
Aught above its rate.
Fear, craft, and avarice
Can not rear a state."

SOME MODERN ASPECTS OF GEOLOGY.*

By GEORGE H. WILLIAMS,
ASSOCIATE PROFESSOR IN THE JOHNS HOPKINS UNIVERSITY.

GEOLOGY has, from the earliest times, claimed the serious attention of mankind, by appealing to two entirely different sides of human character. In the first place, the reverence for the mysterious in nature, which in untutored men amounts to worship, has always been excited by the secrets of the earth; while, in the second place, the cupidity of man has always led him to explore the rocks in quest of the mineral treasures which they contain.

Thus we have at the very outset a *theoretical* and a *practical* interest in geology, both of which have played a most important part in the development of the science. From the earliest times and under various guises we can trace their influence side by side, and they are throughout typical of the two objects with which Nature is always studied—as an end in herself or as a means to an end—as science pure or applied.

The ultimate object of geology is to decipher the complete life-history of our planet. The biologist at his microscope succeeds by patient watching in tracing the entire existence of some minute organism. Often the most surprising metamorphoses of form and function are observed, and more than one generation may be necessary to complete the cycle of changes. Through phases far more varied and through conditions infinitely more complex, we may follow the story of "world-life." The globe, like the organism, is developing according to some inherent law of its own; while among its countless fellow-occupants of space it is hardly more than the single insect amid the myriads which compose its swarm.

* Portion of an address delivered at the commencement exercises of the Worcester Polytechnic Institute, June, 1888.

But the history written in the rocks is long and difficult to read. Here, the record is scanty; there, lost, or, worse still, misleading. Only by the most minute and careful tracing out of every clew can we hope to read aright the glorious tale. A thousand earnest students are collecting observations and comparing their results. Astronomy, physics, chemistry, mineralogy, and biology are all contributing to the sum of what old Mother Earth herself can tell us of her history.

If such a task as this is worthy to arrest the attention and excite the interest of all intelligent men and women, then I may feel justified in speaking of some of the *modern aspects of geology.*

If we would understand the true significance of the present outlook in geological science, we must take at least a glance at its past history.

Ages before it became a science, geology itself existed. The germs of an interest in the history of the earth are as old as man's own questionings about the origin of himself and his surroundings. In the religions of all ancient peoples are cosmogonies and theories of the world innumerable; and fanciful as these are, they still bear witness to an appreciation of the mysterious in nature amounting even to a worship.

With the advent of Christianity and the acceptance of the Bible, geology became a burning question which has hardly ceased to smolder, even in our day. The Mosaic account of the creation and the true meaning of fossil remains were eagerly discussed by the early Church fathers and by the keenest minds of the Renaissance. Tertullian, Leonardo da Vinci, and Voltaire alike exhausted upon them their sharpest wit and their profoundest wisdom. No assertion could be too absurd to secure a following, provided it accorded with the six creative days. One supposed that the shells imbedded in the rocks on mountain-summits owed their existence to a certain "plastic force" inherent in matter; another imagined them produced by the influence of the sun or stars. Still others were so blasphemous in their mad defense of Scripture as to assert that fossils were only the waste *débris* formed in earlier and unsuccessful attempts of the Deity to create a world. And, lastly, Voltaire, in bitter irony, maintained that in his opinion the fossils of the mountains were merely shells dropped from the pilgrims' hats as they journeyed homeward from the Holy Land! The decrees of religious dogma as to what interpretation was to be placed upon facts which the rocks disclosed, were as stern and implacable as those placed by the Church on Galileo; but still more stern and implacable were the facts themselves. For centuries the fierce war raged on one battle-field after another, and from each, Dogma sullenly retired, leaving the victory to Truth. This fascinating phase of the history of geology

has been made the subject of a series of recent papers by President Andrew White. It does not, however, concern us further than to show that, although such violent opposition certainly retarded the early and free development of geology, it was nevertheless not unfavorable to its ultimate success. The wide-spread partisanship excited by theological discussions only disseminated a broader knowledge of the subject, and hence a greater interest in it, so soon as the hindrances to its cultivation were finally removed.

But it is to neither religious persecution nor to religious zeal that we owe our modern science of geology. Dogma and discussion might have been extended indefinitely without approaching one whit nearer to the truth. Observation, not theory, was the one thing needful. While the doctors were deciding whether or not shells could have been strewn over mountain-tops by the waves of Noah's deluge, the "practical men" of the earth were busy in exploring its crust for hidden wealth. Some accurate means of comparing and classifying the strata was to them a matter of necessity, and it need not surprise us to find that the first real geologists were not professors, but "practical" miners; that the earliest germination of a truly scientific study of the earth was not in the university, but in the technical school.

At that remarkable period, about one hundred years ago, when not merely the sciences, but Science herself in the modern sense, sprang into life, geology was doubly prepared to receive the benefit of the great awakening. As she gradually developed from a creed into a science, there was twofold interest in her welfare: the first, theoretical, or, as we may more properly say, theological, since it amounted to a religious fanaticism; the second, practical, and brought about by the growth of mining industries and the search for wealth.

During the past century of geological activity the objective points of these two ideas have been in succession more or less cultivated. Among the theologians the question at issue related to the fossils; among the miners, on the other hand, to the rocks.

Originating, as the systematic study of the earth's crust did, in the mining schools, it is not strange that the latter first received the serious attention of scientific men. The rocks were the earliest objects of investigation, and *petrography*, or the science of rocks, was, naturally enough, the starting-point in geology. But as a science, petrography was, at the outset, a failure, though not on account of any lack of appreciation or patience on the part of its cultivators. Mineralogy throve, but no means could be discovered of applying her methods to the finer-grained rocks, and so the interest in petrography necessarily declined. After repeated

trials, resulting only in disappointment, the students of rocks followed the example of the theologians; and, in lieu of observations and facts, produced only the useless and often virulent polemics of the Neptunist and Vulcanist.

Again, there was a reaction against such waste of energy. Geologists, wearied by more barren controversy, turned eagerly to some new field where observation should be less difficult. They had opened the great book of Nature and had first tried to read the text; but the hieroglyphics were obscure, and the clew could not be found. Is it strange, therefore, that they should have gladly left this hard and unintelligible writing for the picture-book which Nature spread before them in the fossils? Here at least was something tangible. None now doubted that these fossils had once been living organisms which could be understood by careful comparison with living forms.

It was through the study of fossil organisms—or paleontology—that geology first accomplished its true aim, viz., the deciphering of a portion of the earth's history by observed facts. We can hardly wonder that a field so fruitful should, since the beginning of our century, have been cultivated to the exclusion of almost every other. But paleontology is essentially a biological, not a geological science. Its service to the sum of human knowledge can scarcely be overestimated, for it has done much in establishing the greatest generalization of this or perhaps of any century—the doctrine of evolution. Nevertheless, its contributions must ever be to the history of life on the globe, rather than to the history of the life of the globe.

So strong has been the growth of the organic side of our science that a popular idea still prevails that there is no geology aside from stratigraphy and the fossil-bearing rocks. The paleontological school is still in the ascendant, but it is no longer without a vigorous rival.

Within recent years there seems to have been infused into almost every domain of physical science a fresh life. Through gradually acquired generalizations higher points of view have been reached; old notions have been discarded for newer and broader ones. Prof. Langley tells us of the "new astronomy"; the doctrine of the conservation of energy has given us a new physics; evolution, a new biology; and the study of carbon compounds, a new chemistry. So, too, the application of the microscope to the study of rocks has given us a new geology.

The recent development in the science of the earth consists of the return to the work begun by its earliest pioneers. The old Petrographers were right. If we would know the life-history of our planet, we must learn the origin, structural relations, and composition of our rocks. We must discover the forces—chemi-

cal and physical—which work in and upon them, and we must see *how* they work.

As I have already said, the early geologists had full faith in the importance of their labors, but they were forced to abandon them by a lack of methods and appliances suitable to cope with the difficulties presented. To-day this importance is not diminished, but rather increased, by what has been accomplished along other lines. If we can renew the attack upon the old questions with improved weapons, the rewards of victory are as promising as ever. It is believed that such weapons are now in our hands, and the hope of success is almost daily attracting fresh and earnest workers to the ranks from every land.

The first and strongest impetus to a renewed study of the rocks themselves was given by the successful application of the microscope to this end; but this most valuable acquisition has by no means remained alone in the rapid growth of modern petrography. Other appliances, scarcely less useful in rock-study, followed quickly in its wake. Microchemical analysis, the separating funnel, and, most of all, the furnace, in which has been accomplished the perfect synthesis of many rocks, have all contributed, along with the microscope, to make the methods of petrography not inferior in delicacy and accuracy to those of any other science.

The greatest difficulty with which the older geologists had to contend, in their studies of the rocks, was their inability to identify the constituent minerals which composed them. Their disappointment and vexation are still curiously recorded in some of our oldest rock-names, like "*dolerite*," deceptive; and "*aphanite*," not apparent or distinguishable. With the successful application of the microscope to rock-study, this difficulty at once disappeared, and at the same time new and unexpected problems of the greatest interest unfolded themselves in quick succession.

In the light of all that had been done with the aid of the microscope in the organic sciences, it may at first seem strange that its application to geology was so long delayed. This was due to the imaginary difficulties in preparing transparent rock-sections, and to the fact that rock powders had been examined microscopically at an early date with absolutely no result.

In spite of certain sporadic efforts in this direction, it was not until the year 1858 that the clew to the solution of the difficulty was hit upon by Henry Clifton Serby, a wealthy manufacturer of Sheffield, England, who as a pastime succeeded in making transparent rock-sections. These he examined with the microscope with good results, but the matter would hardly have received serious attention by scientific men had he not, almost by accident, transplanted his idea to Germany. In this congenial

soil it readily took root and flourished like a vigorous tree, bearing rich fruit and sending its seeds into every land upon the earth where knowledge is sought for.

At first progress was necessarily slow, mistakes were frequent, and a general interest in the subject was almost lacking. But as one point after another was gained, and as a deeper insight into the problems presented was secured, the number of workers steadily increased. The patient labors of such pioneers as Zirkel, Vogelsang, and Rosenbusch can never be forgotten by those who can now avail themselves of their years of toil in a few months.

Interesting and surprising results were secured at the outset by the new science, but they were mineralogical rather than geological in their bearing. It is only now, after thirty years of preparation, that the time is fully ripe for the application of the new petrography to some of the deepest questions of theoretical geology. This it is which affords almost the only hopeful means of dealing with the records of the crystalline strata of the earth, which undoubtedly contain the longest, as they do by far the darkest, chapter of its history. What paleontology has already done and is still doing for the more superficial strata in which organic remains are preserved, the microscope must do for the crystalline rocks, whether volcanic, plutonic, or metamorphic. These contain their own life-histories, written in characters which need only to be carefully studied in order to be properly interpreted.

The purely mineralogical services of the microscope need not here concern us, but it may be pertinent to inquire, What specific classes of facts has this instrument disclosed and what new ideas has it suggested that entitle it to so high a consideration by those who are interested with the broader problems of the earth's history? To this inquiry we may answer:

1. The microscope has shed light into darkness; and, by its promise of results, has stimulated an enthusiastic cultivation of a most important but hitherto neglected field.

2. It has shown us that the internal structure of the commonest pebble is not less admirable, delicate, and exquisitely beautiful than that of a living organism.

3. It has already thrown much light upon the origin of many of the crystalline rocks—both massive and schists—by allowing us to judge of the conditions under which they must have been formed.

4. Most wonderful of all, it has taught us that the components of the "everlasting hills" are not mere masses of dull, unchangeable, inert matter, but that, in so far as constant change of form and composition to accord with altered conditions is a sign of life, they live.

Any single one of the four points which I have here enumer-

ated is enough to assure a lively interest in modern petrography, not merely on the part of geologists, but on the part of all intelligent persons who love to study the "wonderful wisdom and power of God as shown in his works." Together they promise far more for the future than has been fulfilled in the past.

We can not pause long enough to consider each of these four points in succession, but it will be worth our while to glance for a few moments at the last.

It is a question how far the popularly received distinction between dead and living matter can be made amenable to strict definition as long as we know so little of what the so-called "life-force" is. As far as we can judge of the phenomena presented by the organic and mineral worlds, they differ rather in degree than in kind. This seems like a bold statement, and I am fully aware that it would be totally unwarranted except for the recent disclosures of the microscope in geology.

The chemistry of life is the chemistry of carbon; the chemistry of the rocks is the chemistry of silicon. Both are closely allied elements, with the property of forming extremely complex compounds, which become more or less unstable with a variation of external conditions. We are accustomed to regard unceasing change as a sign of life, and to look upon the rocks as unchanging, and therefore dead. But the microscope shows that this is a false conception. Not only do the component minerals assume a form as directly inherent in their nature as that of a plant; but, if the surrounding conditions become unfavorable, they change to other forms, and leave written in the rocks the records of their often complicated histories. The only difference seems to be in the relative slowness of the action. I say "seems to be," because I am by no means convinced of the absolute identity of the two processes.

In his recent annual address, the well-known President of the Geological Society of London, Prof. John W. Judd, has attempted to throw aside entirely the distinction between crystallized and living matter, and to bring the phenomena of change observed by the microscopist in rocks within the limits of such definitions of life as those of Lewes and Spencer. While we may be unwilling to follow him to this extent, we can but confess that the analogy to vital terms and processes recently used with so much power by Prof. Drummond in quite a different sphere is also capable of a valuable application in illustrating some of the modern aspects of geology. We may speak of the embryology of a mineral, of its histology, morphology, physiology, vitality, and suitability to its environment, designating by these terms phenomena which are at least analogous to those which they represent in biology.

We encounter, in thin sections of both volcanic and metamorphic rocks, microscopic crystals arrested in every stage of their growth, and it is *not* true that these earlier forms are mere epitomes of the perfected individual. We have the fundamental globulite and the complicated and fantastic "growth-forms," which are as different from the finished crystal as is the larva from the butterfly. Thus, to one familiar with such facts as these, there can be no confusion in speaking of the "embryology of a crystal." We think with wonder of the marvelous vitality of seeds which sprouted after three thousand years spent in Egyptian pyramids, and yet the "vitality" of a crystal is such that it will continue its growth under favorable conditions after any number of thousands of years of interruption.

There is, however, nothing among the recent disclosures of the microscope in regard to rocks so surprising as their delicate adjustment to their environment. We are accustomed to look upon the masses of our mountains as the very type of what is stationary and eternal; but in reality they are vast chemical laboratories full of activity and constant change. With every alteration of external conditions or environment, what was a state of stable equilibrium for atoms or molecules ceases to be so. Old unions are ever being broken down and new ones formed. Life in our planet, like life in ourselves, rests fundamentally on chemical action. The vital fluid circulates unceasingly through the arteries of the oceans and the currents of the air; it penetrates the rocks through the finest fissures and invisible cracks, as the human blood penetrates the tissues between artery and vein, producing, with the help of heat and pressure, like changes in the histology of the globe. The recurrence, after a long interval, of the same set of conditions in the same rock-mass, may bring about the unending cycle—analogous to succeeding generations—which Hutton, the earliest of the Scotch geologists, recognized a hundred years ago.

Such processes as these, which properly represent the physiology of our earth's crust, have long been suspected, but their exact nature and details are only now being gradually disclosed by microscopical studies of the rocks.

Suppose, for instance, that a lava-stream bursts from the side of some volcano. As it flows onward, quickly solidifying and crystallizing under circumstances of intense heat, chemical compounds are produced which accord with such conditions, but perhaps not with those ordinarily obtaining at the earth's surface. If this is the case, the hardened lava will be in a chemically unstable state, and will tend in turn to adapt itself to its new surroundings by chemical change.

Countless examples of this adaptability of rocks to their envi-

ronment are familiar to every geologist who has availed himself of the newest and most potent aid in his profession. There is nothing hypothetical about them, for the minerals have written their own "life-histories" in characters which can not be misread. They throw a flood of light upon many types of rocks whose origin and nature have heretofore remained an unsolved riddle; and they open up a vista of possibilities to the future explorer whose length and whose attractiveness can hardly be exaggerated.

Let me quote, in closing this brief survey of a new field in geology, a single passage from Prof. Judd:

"In the profound laboratories of our earth's crust," he says, "slow physical and chemical operations, resulting from the interaction between the crystal, with its wonderful molecular structure, and the external agencies which environ it, have given rise to new structures, too minute, it may be, to be traced by our microscopes, but capable of so playing with the light-waves as to startle us with new beauties, and to add another to

> 'The fairy tales of science,
> And the long results of time.'

"Yes! minerals have a *life-history*, one which is in part determined by their original constitution, and in part by the long series of slowly varying conditions to which they have since been subjected. . . . In spite of the limitations placed upon us by our brief existence on the globe, it is ours to follow, in all its complicated sequence this procession of events; to discover the delicate organization in which they originate; to determine the varied conditions by which they have been controlled; and to assign to each of them the part which it has played in the wonderful history of our globe during the countless ages of the past.

"Mineralogy has been justly styled the alphabet of petrology; but if the orthography and etymology of the language of rocks lie in the province of the mineralogist, its syntax and prosody belong to the realm of the geologist. In that language, of which the letters are minerals and the words are rock-types, I am persuaded that there is written for us the whole story of terrestrial evolution."

CONCLUDING its review of the report of the Krakatoa Committee of the Royal Society, "Nature" calls attention to the fact that the study of the sequelæ of the great explosion "has not merely enlarged our conceptions of volcanic powers and the continuity of atmospheric circulation, as well as yielded positive information of great value to different branches of science, but has opened up fresh problems in optical and meteorological physics, the attack and solution of which will stimulate research as well as materially advance the boundaries of our present knowledge of these subjects."

ANIMAL LIFE IN THE GULF STREAM.

By RALPH S. TARR.

IN the Gulf Stream, near the surface, animal life is extremely abundant, both young and adult finding the warm waters of the current peculiarly adapted for life and rapid growth. Cuttle-fish swim about, chased by sword-fish, dolphins, and sharks. Attracted by the glare of the electric lights in the evening, large schools sport around the United States Fish Commission steamer Albatross, swimming backward and forward with equal facility, leaping out of water and ejecting their black, inky fluid whenever surprised. Many devices were tried for the capture of one of these quick-motioned creatures, but we failed to secure any until an ingenious sailor rigged a peculiar spear, which, when properly used, would bring the cuttle-fish on board. This curious animal, classed by naturalists among the mollusks, or shell-fish, has so little resemblance to its relatives, oysters and clams, that an average observer would be far more likely to place it among the true fishes. It has large, prominent eyes, and its mouth is armed with a horny beak, very much like a parrot's bill. With this it undoubtedly proves itself a dangerous enemy to many marine animals. Forward motion is obtained by a fin-like tail, while it moves backward by suddenly forcing water out of a bag having its opening near the creature's mouth. Ten arms or feelers, with their inner surfaces lined with suckers, are arranged about the mouth. Although it seldom grows over a foot long, an embrace from its arms is painful. How much more so must it be in the case of the large octopus, or devil-fish, of the North, which is often forty feet in length, measured from the tips of the two long arms! In this latter animal the suckers are sometimes two inches in diameter, and, when worked by the powerful muscles, painful wounds can be produced. From earliest times fabulous accounts of a creature like this have been circulated,

FIG. 1.—CUTTLE-FISH (*Sepia officinalis*) AND SHELL.

but it was not until 1870 that this animal was accurately studied and described by responsible persons. Previous to that time it was regarded with the same skepticism that the sea-serpent now

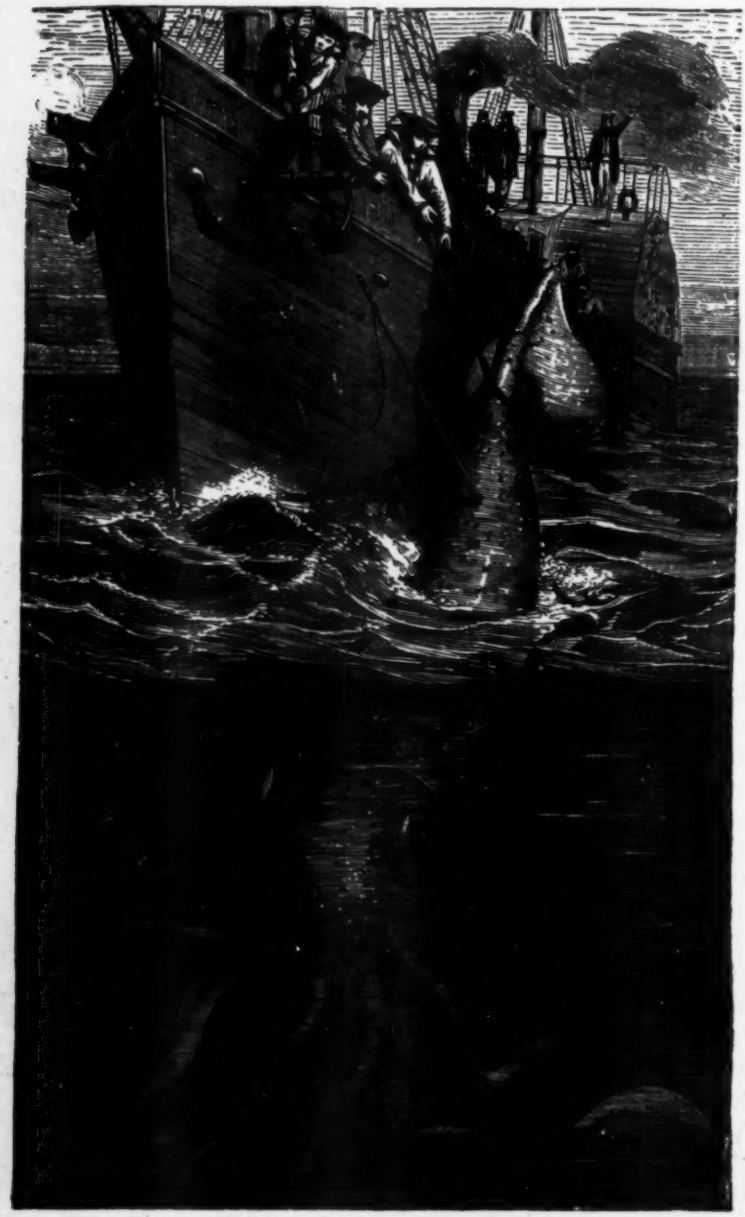


FIG. 2.—CAPTURE OF A GIANT SQUID.

is by many. However, naturalists are beginning to look upon the sea-serpent theory with more favor, while a few are active

supporters of the belief that the sea is still possessed of some descendants of the enormous fish-like reptiles which inhabited it in early geological periods. A fair picture but poor description of an octopus is given by Victor Hugo in his "Toilers of the Sea." He, in the course of his description, becomes very much confused, mixing devil-fish with polyp, and describing an animal possessed of habits belonging to each of these two widely separated groups. The confusion apparently arises from the fact that a common name for the octopus is *poulp*, but this etymological resemblance to the polyp, or sea-anemone, is the only one. He also confounds the name *Cephalopoda* with *Cephaloptera*, a gigantic ray or skate, also called devil-fish, and this causes new confusion in the description. There are gigantic octopi in the Southern waters, and these furnish food for the toothed sperm whale. Our Northern devil-fish is not a true octopus, but a squid, for it has ten arms instead of eight.

A sword-fish captured during the voyage was found to have in its stomach over thirty eyes and twenty beaks of the small cuttle-fish, together with a few partly digested individuals. Sword-fishes and sharks are natural enemies, always fighting when they meet, and there are accounts of fierce and deadly encounters between them. An ugly sword-fish is a bad enemy to encounter, using its weapon, as it does, with such ease and force. One will often drive its sword through the bottom of a boat, and, if it succeeds in withdrawing it without breaking it off, the boat rapidly fills with water, and the occupants, driven into the sea, are savagely attacked and badly wounded by the furious fish. At times they are abundant on all sides, lying near the surface, with their dorsal fin projecting above.

A sailor speared a dolphin one day, much to our surprise, for they seldom came near enough to reach. For several days there had been a school around, probably attracted by the refuse thrown overboard, by the brilliant light at night, and by the cuttle-fish which kept near the vessel. They usually remained many feet below the surface, and, viewed through the deep azure-blue water of the Gulf Stream, the different colors of their bodies reflected in the sunlight, and again in the electric light, were beautiful in an extreme degree. At last one, coming too near the surface, received a fatal wound, and was successfully brought on deck. I had often heard of the changing colors of a dying dolphin, and now I was to witness them for the first time. No one can exaggerate the weird beauty of the sight as the fish in its last struggles changes through all its various hues. One can see the colors disappear, to be followed by others. Beginning with the head, they seem to sweep as a wave over the body. Blue gives place to white, then a light yellow, which in turn changes to a

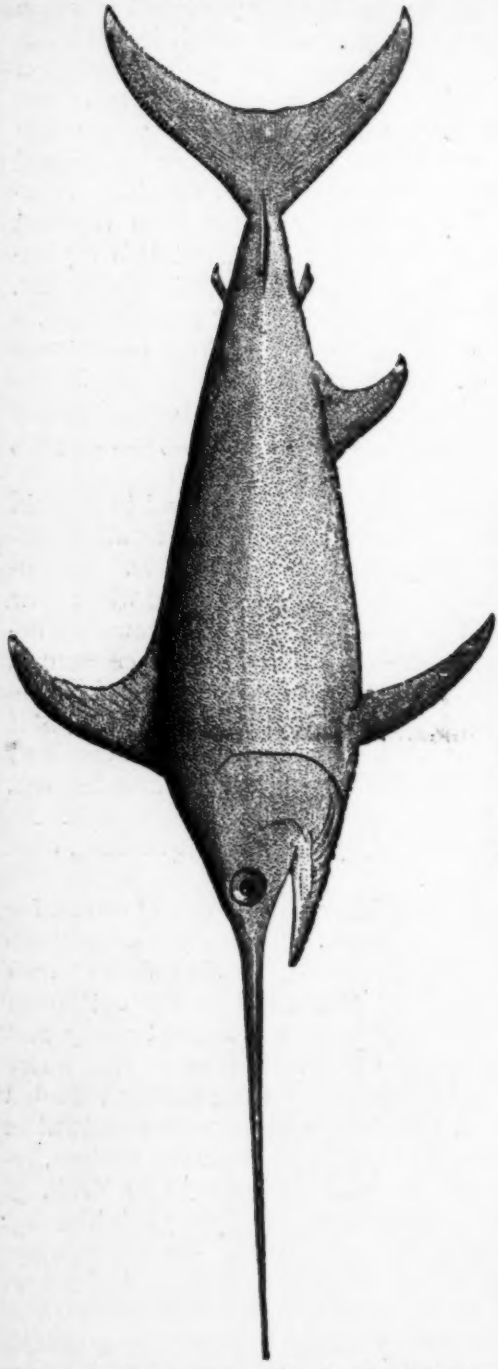


FIG. 8.—THE SWORD-FISH (*Xiphias gladius*).

golden, and following this a copper-colored tint; and so on through all conceivable hues, until finally, the end having come, change is interrupted in its course, and two tints are left in possession of the body—one in the act of disappearing, the other about to spread itself over the surface. That portion exposed to sunlight changes more rapidly, while the under side is less gorgeous. Here we see a peculiar property possessed by many animals widely separated in the scale of life—that of changing color at will, either to suit the surrounding shade, as illustrated in the chameleon and dolphin, or to attract certain kinds of prey, as seen in many of the lower marine animals—which becomes so much a habit in the case under consideration that, even when death is at hand, the changes are all passed through involuntarily.

Stormy petrels, or Mother Carey's chickens, as they are more commonly called, follow the outbound vessel in large flocks, gathering about as soon as land is lost to view, and remaining until the shore is once more sighted, unless a violent storm drives them

away. For the most part they feed upon refuse thrown overboard, but are never fat and always hungry, due undoubtedly to the fact that they are almost continually upon the wing, seldom being

FIG. 4.—FLYING-FISH (*Exocœtus*) PURSUED BY THE DOLPHIN.

seen resting. Hovering over the food in a peculiar manner, by patting the water with its webbed feet and quickly flapping its wings, it appears to stand on the water, and, following the food as it is drifted about, to walk along. Sailors regard it with great superstition, and believe that some calamity will follow the wanton killing of this bird. They seem to have no fear of man, for they constantly flew near and aboard the vessel. Attracted by the lights, many flew aboard at night, and, striking the house, fell senseless to the deck. These birds must have a very short and irregular breeding period, for they are found several hundred miles from land, at all seasons of the year. They probably go in flocks, at different times, to their favorite breeding-place, and after a short period, having raised one brood, they return.

FIG. 5.—STORMY PETREL (*Thalassidroma pelagica*).

Physalia, the Portuguese man-of-war, with its beautiful blue float, may at times be seen on all sides. The float, filled with air, serves to keep the animal on the surface, and, driven by the wind, to bear it from place to place. It is a curious animal, or rather cluster of animals we should say, for naturalists now consider it to be a group of individuals, having different functions, but working for the same general cause—that of supporting the mass. They say that in this group there are some whose sole purpose is to obtain food, some to digest, others to reproduce, etc., yet each is an individual animal working for the good of the whole, that the whole may work for its good, and that in conjunction they may perform all the functions of life necessary to the well-being and general welfare of the whole united colony. The cluster has most remarkable defensive powers, being well furnished with lasso cells or stinging organs. These consist of little barbed, arrow-like points, fastened to thread-like arms, each of which is coiled up in a little cell. Whenever it is necessary to use them they are hurled out with violence, and each barb, striking the object, penetrates, for it has the power of "working into" flesh, and, being covered with a sort of poison, it in conjunction with many others benumbs the prey and renders it harmless. That the *Physalia* possesses this property to a marked degree, some of the sailors of the Albatross can testify, for they incautiously placed their hands in a tub of water containing one, and the shock they received was compared in violence to a strong shock from a Leyden jar. Sea-anemones possess this same property, although the common shore species can affect only very tender animals. I have seen a deep-sea anemone, six inches in length, by this means kill and afterward swallow a lively fish a foot long, that was placed in the aquarium with it. The fish barely touched the anemone, then seemed incapable of moving farther, and after a few struggles became paralyzed. These arrow-points possess the power of motion for several hours after being detached from the animal. Lasso cells can be replaced when lost, and in a very short time. On a square foot there are millions of cells. It is a curious fact that all well-defended animals

FIG. 6.—PORTUGUESE MAN-OF-WAR (*Physalia arethusa*).

—I speak with particular reference to the lower marine animals—are usually brilliantly colored. This can be seen in the case of sea-anemones, tropical shells, and crabs. Those with little or no defense are inconspicuous and resemble surrounding objects. The reason for all this is plain, for if inconspicuous they easily escape the notice of their enemies. Brilliant, well-defended animals have little fear of enemies, but by their bright colors will attract curious animals within reach of their deadly powers.

Like the *Physalia* in general structure, and in the fact that they possess stinging cells, are the jelly-fishes, which are present in the Gulf Stream in a great abundance of forms. There are

FIG. 7.—A JELLY-FISH SWIMMING.

bell-shaped, tubular, spherical, discoidal, and many other forms, most being transparent, but some very brilliantly colored. One of the disk-like forms is colored with deep purple and orange bands radiating from the center, while from the entire circumference hang many transparent tentacles. The mouth of most jelly-fishes is beneath, in the center of the bell, and is surrounded by tentacles which procure food. These are also furnished with stinging cells by which the food is killed. Their modes of repro-

duction are curious. In some a portion of the body of the parent begins to grow out, and this continues until a perfect bud-like protuberance is the result, and then the bud drops off and, after various interesting changes, becomes a fully formed jelly-fish. Sometimes the parent begins to divide, and actually splits into two parts, each of which becomes a perfect animal.

So great is the transparency of most jelly-fishes that they are scarcely visible; but at night, what a change takes place! When a school is passed, the water becomes suddenly transformed to a mass of liquid fire, composed of individual balls that together, on account of their great number, appear as one vast sheet of light. When they are disturbed, their brilliancy is increased. Far different from the jelly-fish in structure, but resembling it in its phosphorescence, is *Pyrosoma*, a colony of animals often found in these warm waters, which together form a fleshy mass, possessing no remarkable points by day, but at night becoming most brilliantly phosphorescent. In the mass, six inches in length, there are hundreds of separate animals, each like the others, all massed together in a common colony. They are very curious, for, while most of the young remain to help build the mother colony, some become entirely separate, and, after swimming about for a while, begin a new cluster that soon takes the form of the parent group. Each group has a regular shape just like the original one. The same is true of corals and most other clusters formed of more than one individual.

In our surface towings we find many beautiful animals, but none have impressed me so strongly as the so-called sea-butterflies. They are small, usually, and seldom found in abundance, and, being thus inconspicuous, are not likely to be seen by those not specially searching for them. Every color is found in these beautiful forms, and, as they float upon the surface, with their wing-like expansions spread out to catch the wind, but a small amount of imagination is needed to transform them into true butterflies accidentally fallen into the water. They have a very light and beautiful shell, with an air-chamber above to serve as a float, while from a lower compartment the wings are expanded. When startled, their sails are withdrawn into this chamber, and the oddly shaped shell is alone exposed to view. Sea-butterflies can, by arranging their sails so as to utilize the wind in the most effective manner, guide their course to a certain extent, just as the ship can proceed against a head wind. Their shells, which are often taken without the animal, present many very peculiar forms, from the nearly round to the long, sharply pointed ones, some with spines, others perfectly smooth; and we can see them in every conceivable color, the glassy, transparent kinds, the milk-white, and masses of the most brilliant colors, so confusing

and varied as to defy all comparison or description. These little animals, living in the water and moving from place to place, are as perfect and sea-worthy ships in miniature as the best modern vessels, and built upon as improved a pattern as our vessels which have been so long evolving. They have for centuries plowed the open seas in their vessels, never seeking port and never suffering disaster. With their air-float above, in addition to buoyancy, perfect stability is obtained. Their body below serves as ballast, and their membranous wings are good sails, that can be furled or hoisted at the animal's will. No masts to be carried away, no anchor needed, but perfect safety always. How well adapted for their surroundings—indeed, how well all Nature's creatures are adapted for their mode of life! How many ideas in modern architecture and engineering, but just discovered as the result of long study and experiment, have been in use for centuries untold among the lower animals which we are so wont to regard as unworthy of life! The ant, the bee, the spider, and hundreds of others are to-day using principles which man has yet to learn. The properties of the arch and dome, if not first learned from animals, might have been, much to man's advantage, long before he discovered them.

On very rare occasions the nautilus is found, and at times we also fall in with the *Argonauta*, or paper nautilus. They are both related to cuttle-fishes, differing from them in having shelly coverings and in some other more technical points. Each has a row of arms, with suckers around the mouth, and they move in the same manner as true cuttle-fishes do—by ejecting a quantity of water through a tube with such force as to drive the animal backward. The nautilus, as it grows, builds the shell larger to accommodate the growing body, building on the edge and continuing the spiral, and at the same time forming a partition across the rear. If a nautilus-shell is cut longitudinally, it will be found to be made up of a large anterior chamber, which the animal occupied just before it died, and behind a large number of chambers separated from each other by transverse partitions, and connected together only by a small circular hole that exists in each partition. When the nautilus is alive, a fleshy tube runs through all these chambers, passing through the holes, and forms the only connection between the animal and the rear chambers once inhabited by it. It is thought that by means of this tube the rear compartments can be filled with water or emptied at the animal's will, thus allowing it either to rise to the surface or to sink to any required depth. *Argonauta* is a pure white, ridged shell, thin and delicate, the animal being very much like the nautilus; but in this case the female alone has the covering, while the male is entirely without a shell. In many cases, among the lower forms of ani-

mal life, the male is unprotected, while the female is covered by some very perfect shell, or is otherwise well fitted for self-protection, all undoubtedly for the preservation of the young. The higher we ascend in the animal kingdom the more we see the opposite extreme, the male being the best fitted to defend, and hence assuming both its own protection and that of the weaker sex. Far back in remote geological periods animals resembling

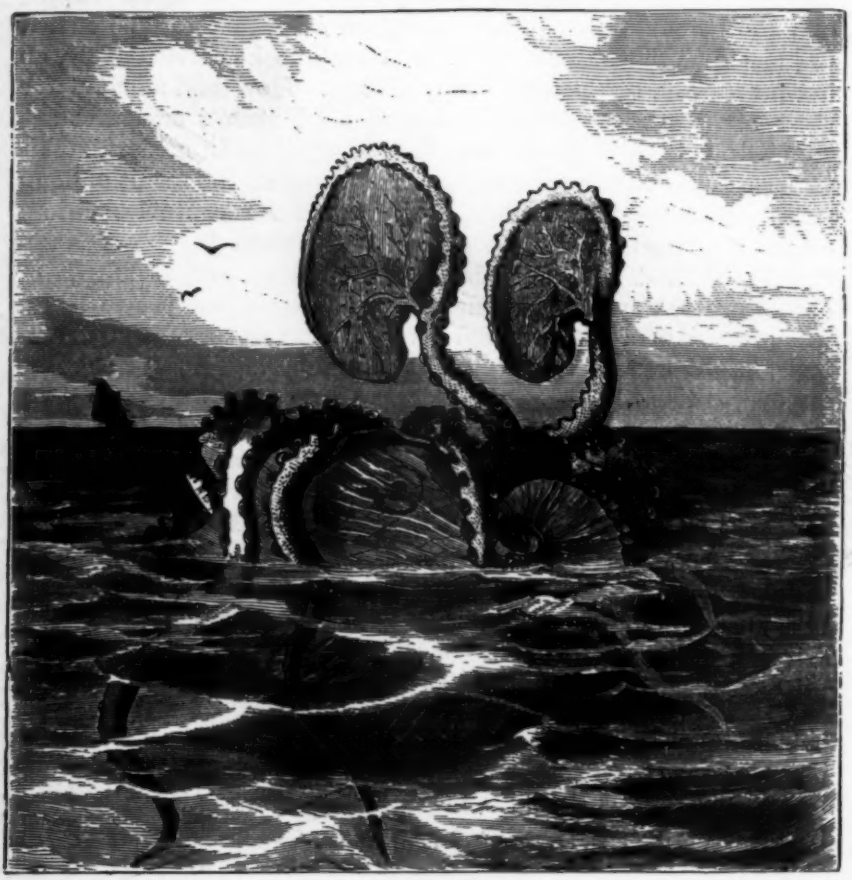


FIG. 8.—THE ARGONAUT.

the nautilus and *Argonauta* were extremely abundant, and also forms even more primitive than these; but to-day we have only a very few as representatives of this large group of fossil animals.

The surface-waters in the Gulf Stream teem with minute life of all kinds. There the young of larger animals exist, microscopic in size; and adult animals which never grow large enough to be plainly visible to the naked eye occur in immense quantities. By dragging a fine silk net behind the vessel, these minute forms are easily taken, and when placed in glass dishes millions uncount-

ed are seen swimming backward and forward. When looked at through a microscope we see young jelly-fishes, the young of barnacles, crabs, and shrimps, besides the adult microscopic species, which are very abundant. The toothless whale finds in these his only food. Rushing through the water, with mouth wide open, by means of his whalebone strainers the minute forms are separated from the water. Swallowing those obtained after a short period of straining, he repeats the operation. The abundance of this kind of life can be judged from the fact that nearly all kinds of whales exist exclusively upon these animals, most of them so small that they are not noticed on the surface. Prominent among the animals obtained from the surface towings is *Sapharina*, a small crustacean which is remarkably iridescent, flashing in the sunlight with metallic colors. It darts swiftly about, now green, now blue, and very conspicuous on account of its ever-changing hues. Another similar form is red. At all times, and in nearly all places, both in the Gulf Stream and in the warmer waters outside, there is an interesting transparent animal called *Salpa*. At first glance it would appear to be structureless, but, if carefully studied, a mouth, a stomach, and other organs will be found, which place it among the higher invertebrate animals. They swim around in large schools, but on account of their great transparency are scarcely visible. Whether or not they serve as food for other animals I do not know, but it seems that a meal made of them would be rather unsatisfactory on account of the great quantity of salt water that enters into their construction. They often have a curious blue parasite inside the body walls, and this is about the only visible sign of structure. Very few animals are free from parasites, and in the fishes they are numerous, burrowing into the gills, in the roof of the mouth, and all over the external portions of the body. On sharks we sometimes find them four inches long, an inch of which extends into the flesh. There is one called *Penella*, which is very long, and has a hairy tuft on the outer end. In most cases this parasite has attached to the external stem a species of barnacle, which itself has small parasites. Parasitic tendencies degenerate an animal, so that many of the once essential organs become useless and are lost. We see this well illustrated in *Penella*, which is an ally to the shrimp, but has so changed, by losing its feet and other organs, as to bear but little resemblance to these higher crustaceans. Degeneration is still

FIG. 9.—DOLIOLUM (AN ASCIDIAN ALLIED TO THE SALPA).

better illustrated by certain worm-like animals which live in the stomachs of sharks and other fishes. Being placed where food is ground up fine and all ready for assimilation, there is no need of a mouth, and but little need of a stomach, so both of these organs are lost, and all food is absorbed into the system through the outer walls of the body. Eyes are also lost, and the animal becomes a mere stomach; but, as for that matter, most animals are a mere stomach, with a few necessary organs to assist it. Some true fishes can be classed as parasites, while many use other animals as a means of attachment and protection. Under the dome of the true bell-shaped jelly-fish, a species of fish is generally found that is never taken under other conditions. It appears not to be affected by the stinging cells of the animal, but will stay near the mouth while the darts are exerting their deadly powers upon some brother-fish, and after this fish is dead will pick up enough for a meal from what the jelly-fish does not eat. What benefit this fish is to the jelly-fish it would be impossible to say, but in such cases some service is usually returned, such, for example, as that of warning the friend in case of danger. This habit of commensalism, or eating at the same table, is seen in other animals, as the oyster-crab, pilot-fish, and others. They seem to recognize their friends, and not only do not harm but even protect them. The oyster-crab could, if so inclined, devour the oyster without trouble, but it never offers to. Under such conditions certain apparently deadly powers have no effect, and these animals may even be entirely unharmed by digestive fluids. Fish are sometimes found in very odd places. One burrows into the side of a larger fish and stays there, as in a house, catching what food passes by. Another fastens itself on to the sides of a fish by means of a sucker, and, assuming a similar color to that of the larger one, is easily overlooked by its enemies. One of these, the lump-fish, is a very pretty green in color. There are certain fishes that always stay in the surf near shore, being able to remain there without being cast ashore, and never seeking quiet water.

Among the patches of sea-weed which float in the Gulf Stream there are numerous small fishes very prettily colored. One among these has a curious mode of defense, and because of this is called the file-fish. Normally folded down upon its back is a rather long spine. Whenever danger is apprehended, this spine suddenly springs upright, and is held there by a little bone behind it near the base and under the skin. If this bone is touched with a knife, it can be pressed down, and then the spine will fold back; but, unless the bone is removed, the spine will remain rigidly upright. The fish possesses the power of raising or lowering the spine at will. We sometimes see flying-fish jump out of the water and scale along the surface for many feet. Chased by their enemies,

they seek safety in the air, and, after darting as far as possible, will strike the water again and then dash off in another direction. They present a very odd appearance, skipping out of the water and passing through the air by means of their wing-like fins, and then again disappearing. While trying to escape their finny enemies they often fly right into the claws of an albatross or some other large sea-bird, jumping, so to speak, "from the frying-pan into the fire." A hard lot is theirs in this struggle for existence, eating smaller animals only to be themselves eaten. The panic which a shark will cause in a school of mackerel or menhaden, or a dolphin among flying-fish, can hardly be described. Another curious fish that we sometimes meet with is the *Hippocampus*, or sea-horse. These little creatures are most interesting to watch in an aquarium. They curl their tails about any object which will hold them in place, and then assume an upright position. With their peculiarly shaped head and large, intelligent eyes, an almost perfect miniature resemblance to a horse is plainly seen. There

FIG. 10.—SEA-HORSE (*Hippocampus brevirostris*).

FIG. 11.—GOOSE BARNACLES ON A BOTTLE.

it sits motionless, rolling its prominent eyes backward and forward until a small animal comes too near, when a sudden dive is made, which generally ends fatally to the intended prey, and then the same grave indifference is assumed. Altogether it reminds me of a toad watching for its food.

Floating around on all sides are numerous patches of gulf-weed filled with life of all kinds. Here good-sized crabs and shrimps flee for refuge from larger foes, and feed upon their more minute brethren also seeking safety under the floating weed. Here the goose barnacle is found in great numbers attached to everything that floats. This is the animal which is such an enemy to shipmasters sailing from tropical ports. Although the vessel's

bottom is scraped just before leaving port, young goose barnacles attach themselves in such numbers that, owing to their rapid growth, they seriously retard the ship's progress. There is no remedy but to sail on, letting them grow as fast as they will, and removing them when port is reached. Norwegian sailors believe that the barnacle goose hatches out of the goose barnacle, and many have asserted that they have seen the young just on the point of flying out. This belief probably arises from the peculiar scooping motion of the fringed feet of the barnacle while it is obtaining food. Even then a good imagination needs some stretching to be able to see a resemblance to a young bird. When a barnacle is young, it is free-swimming, and resembles a shrimp; but, as it grows older, it attaches itself to some object by a sort of cement, and becomes so changed that, unless its anatomy is carefully studied, no affinities to a shrimp would be imagined. Indeed, early naturalists considered it to be a shell-fish or mollusk. Odd as it may seem, many kinds of animals, at first possessed of free motion, voluntarily attach themselves to some object, and are from that moment imprisoned, having no power of moving from place to place.

Insects are seldom seen in a natural state far from land, but we find a few young forms a little nearer shore, and one of these, a fly larva (*Chironomus*), is more interesting than the others on account of its remarkable powers of endurance. Experiments were tried, and we found that it would live after being taken out of a vial of alcohol in which it had been kept several hours. Most animals, under similar conditions, will die in five minutes, and the most hardy in twenty. Different poisons were tried, and none were effective. Even caustic potash was resisted for nearly an hour. In the mean time the creature would swim around lively. Such hardiness is probably found in no other animal. In addition to these more interesting forms, there are hundreds of species each presenting some especial peculiarity which distinguishes it from the rest, and all have interesting habits and points of structure. The waters of the Gulf Stream gradually merge into those of the ocean on either side, and, while there are some peculiarly tropical forms which never go outside of the warm water, most are likely to be taken on either side in the colder waters, and there are many which are found both near shore and in the Gulf Stream. After long-continued southerly winds, tropical forms are at times cast on shore; and vessels passing through the Gulf Stream frequently bring into port, attached to their bottoms, crabs and shrimps which normally do not live in the inner region. The warm waters of this part of the ocean are very favorable to rapid growth, and the animals there are tropical. Washing the shores of Florida, the Gulf Stream serves to transport its

animals to Europe, and the many kinds which we have been considering are thus carried from place to place without their own guidance. Thus it is that the tropical faunæ of the two sides of the Atlantic so closely resemble each other. The Gulf Stream, then, serves not only to modify the climate of naturally cold regions, but also to distribute life equally on two different shores, which, without some such communication, would have animals as decidedly different as are those of Asia from American east coast species.

HUXLEY AND PASTEUR ON THE PREVENTION OF HYDROPHOBIA.

AT the call of the Lord Mayor, a meeting was held at the Mansion House, in London, on the 1st of July, to hear statements from men of science with regard to the recent increase of rabies in England and the efficacy of the treatment discovered by M. Pasteur for the prevention of hydrophobia. Among several letters that were read, the following, one from Prof. Huxley and the other from M. Pasteur himself, are of especial interest:

"MONTE GENERASO, SWITZERLAND, *June 25, 1889.*

"MY LORD MAYOR: I greatly regret my inability to be present at the meeting which is to be held under your lordship's auspices in reference to M. Pasteur and his institute. The unremitting labors of that eminent Frenchman during the last half-century have yielded rich harvests of new truths, and are models of exact and refined research. As such they deserve and have received all the honors which those who are the best judges of their purely scientific merits are able to bestow. But it so happens that these subtle and patient searchings out of the ways of the infinitely little—of that swarming life where the creature that measures one thousandth part of an inch is a giant—have also yielded results of supreme practical importance. The path of M. Pasteur's investigations is strewed with gifts of vast monetary value to the silk-trader, the brewer, and the wine merchant. And, this being so, it might well be a proper and a graceful act on the part of the representatives of trade and commerce in its greatest center to make some public recognition of M. Pasteur's services even if there were nothing further to be said about them. But there is much more to be said. M. Pasteur's direct and indirect contributions to our knowledge of the causes of diseased states, and of the means of preventing their occurrence, are not measurable by money values, but by those of healthy life and diminished suffering to men. Medicine, surgery, and hygiene have all been pow-

erfully affected by M. Pasteur's work, which has culminated in his method of treating hydrophobia. I can not conceive that any competently instructed person can consider M. Pasteur's labors in this direction without arriving at the conclusion that, if any man has earned the praise and honor of his fellows, he has. I find it no less difficult to imagine that our wealthy country should be other than ashamed to continue to allow its citizens to profit by the treatment freely given at the institute without contributing to its support. Opposition to the proposals which your lordship sanctions would be equally inconceivable if it arose out of nothing but the facts of the case thus presented. But the opposition which, as I see from the English papers, is threatened, has really for the most part nothing on earth to do either with M. Pasteur's merits or with the efficacy of his method of treating hydrophobia. It proceeds partly from the fanatics of *laissez faire*, who think it better to rot and die than to be kept whole and lively by state interference, partly from the blind opponents of properly conducted physiological experimentation, who prefer that men should suffer rather than rabbits or dogs, and partly from those who for other but not less powerful motives hate everything which contributes to prove the value of strictly scientific methods of inquiry in all those questions which affect the welfare of society. I sincerely trust that the good sense of the meeting over which your lordship will preside will preserve it from being influenced by these unworthy antagonisms, and that the just and benevolent enterprise you have undertaken may have a happy issue.

"I am, my Lord Mayor, your obedient servant,

"THOMAS H. HUXLEY.

"The Right Hon. the Lord Mayor, Mansion House, E. C."

The following letter from M. Pasteur, dated Paris, the 27th ult., was read by Sir H. Roscoe:

"DEAR COLLEAGUE AND FRIEND: I am obliged by your sending me a copy of the letter of invitation issued by the Lord Mayor for the meeting on July 1st. Its perusal has given me great pleasure. The questions relating to the prophylactic treatment for hydrophobia in persons who have been bitten and the steps which ought to be taken to stamp out the disease are discussed in a manner both exact and judicious. Seeing that hydrophobia has existed in England for a long time, and that medical science has failed to ward off the occurrence even of the premonitory symptoms, it is clear that the prophylactic method of treating this malady which I have discovered ought to be adopted in the case of every person bitten by a rabid animal. The treatment required by this method is painless during the whole of its course and not disagreeable. In the early days of the application of this method,

contradictions such as invariably take place with every new discovery were found to occur, and especially for the reason that it is not every bite by a rabid animal which gives rise to a fatal outburst of hydrophobia. Hence prejudiced people may pretend that all the successful cases of treatment were cases in which the natural contagion of the disease had not taken effect. This specious reasoning has gradually lost its force with the continually increasing number of persons treated. To-day, and speaking solely for the one anti-rabic laboratory of Paris, this total number exceeds 7,000, or exactly, up to the 31st of May, 1889, 6,950. Of these the total number of deaths was only seventy-one. It is only by palpable and willful misrepresentation that a number differing from the above, and differing by more than double, has been published by those who are systematic enemies of the method. In short, the general mortality applicable to the whole of the operations is one per cent, and if we subtract from the total number of deaths those of persons in whom the symptoms of hydrophobia appeared a few days after the treatment—that is to say, cases in which hydrophobia had burst out (often owing to delay in arrival) before the curative process was completed—the general mortality is reduced to 0·68 per cent. But let us for the present only consider the facts relating to the English subjects whom we have treated in Paris. Up to May 31, 1889, their total number was two hundred and fourteen. Of these there have been five unsuccessful cases after completion of the treatment and two more during treatment, or a total mortality of 3·2 per cent, or more properly 2·3 per cent. But the method of treatment has been continually undergoing improvement, so that in 1888 and 1889, on a total of sixty-four English persons bitten by mad dogs and treated in Paris, not a single case has succumbed, although among these sixty-four there were ten individuals bitten on the head and fifty-four bitten on the limbs, often to a very serious extent. I have already said that the Lord Mayor in his invitation has treated the subject in a judicious manner, from the double point of view of prophylaxis after the bite and of the extinction of the disease by administrative measures. It is also my own profound conviction that a rigorous observance of simple police regulations would altogether stamp out hydrophobia in a country like the British Isles. Why am I so confident of this? Because, in spite of an old-fashioned and wide-spread prejudice, to which even science has sometimes given a mistaken countenance, rabies is never spontaneous. It is caused, without a single exception, by the bite of an animal affected with the malady. It is needless to say that in the beginning there must have been a first case of hydrophobia. This is certain; but to try to solve this problem is to raise uselessly the question of the origin of life itself. It is sufficient for me here, in

order to prove the truth of my assertion, to remind you that neither in Norway, nor in Sweden, nor in Australia, does rabies exist; and yet nothing would be easier than to introduce this terrible disease into those countries by importing a few mad dogs. Let England, which has exterminated its wolves, make a vigorous effort and it will easily succeed in extirpating rabies. If firmly resolved to do so, your country may secure this great benefit in a few years; but, until that has been accomplished, and in the present state of science, it is absolutely necessary that all persons bitten by mad dogs should be compelled to undergo the anti-rabic treatment. Such, it seems, is a summary of the statement of the case by the Lord Mayor. The Pasteur Institute is profoundly touched by the movement in support of the meeting. The interest which his Royal Highness the Prince of Wales has evinced in the proposed manifestation is of itself enough to secure its success. Allow me, my dear colleague, to express my feelings of affectionate devotion."—*Nature.*

ORIGIN OF THE RIGHTS OF PROPERTY.

By HENRY J. PHILPOTT.

IN the joint enterprise of making a living, human beings not only potentiate but they also stimulate one another. The power and the stimulus are often combined, just as some foods furnish at the same time nutrition and stimulation to the human body. Sometimes we may distinguish between the two elements. It is so in the case of property. Wealth is power. Property is a stimulant. In order to make this distinction clear, we draw another. We must explain the difference in meaning between wealth and property. This will not be a hard task. Property is ownership, and wealth is the thing owned. Wealth is a thing, property a right to it. Wealth is mine and thine, property mineness and thineness. True, we often confuse the terms, and speak of the thing itself as property; especially do we speak of a body of real estate as a piece of property. This is justified by usage and by the dictionaries. For the present, however, I should like to confine the term to its original meaning. In this I shall follow Macleod, who says:

"When we understand the true meaning of the word property, it will throw a blaze of light over the whole science of economics, and clear up difficulties to which the word wealth has given rise; in fact, the meaning of the word property is the key to all economics.

"Most persons, when they hear the word property, think of

some material things, such as lands, houses, money, corn, cattle, etc. But that is not the true and original meaning of the word property.

"Property, in its true and original meaning, is not any material substance, but the absolute right to something."

It is in the same sense that the socialists use the word. When they demand the abolition of property they do not mean the abolition of lands, houses, etc. They are as anxious as anybody that wealth shall be increased. But they want it to be *ours*, not mine or thine. Wealth which belongs to the whole people is not property in the economic sense of the term. It is conceivable, though not practically ascertainable, that property might be totally abolished without any diminution of wealth. So property may be increased without any increase of wealth. There would be just as much land-surface on the earth if nobody owned a rood of it. There were as many negroes after as before the abolition of property in man. The abolition proclamation did not obliterate a single acre of land, a house, a shred of clothing, or a mouthful of food. But it did obliterate a vast amount of property; so does a commercial panic. "And yet," says Prof. Newcomb, using the panic of 1837 as an illustration, "if we look at the case from a common-sense point of view, we shall see that no wealth was destroyed. There were just as many suits of clothes in the country the day after the crisis as there were before, and they were just as well fitted for wearing. The mills and factories were all in as good order, the farms as fertile, and the crops as large after the supposed hurricane as before. The houses remained standing, the wood was in the wood-sheds ready for burning, and the food in the larder ready for cooking, just as it had been left. In a word, every appliance for the continued enjoyment of the fruits of labor remained as perfect as it ever was."

Prof. F. A. Walker, in calling attention to the distinction between wealth and property, says that "the neglect of this distinction has caused great confusion." But he soon dismisses the subject with the remark that "we might say that 'property' is not a word with which the political economist has anything to do. It is legal, not economical, in its significance." I can not concur in that opinion. I think the socialistic theory, which relates primarily to the institution of property, is an economic theory, as truly as monometalism, or free trade, or Malthusianism. The whole subject of distribution, to which Prof. Walker devotes a hundred pages, and which is certainly one of the most important in this or any other science, is a question of whose shall be the wealth produced; that is, it is a question of the distribution of property in the wealth, rather than of the wealth itself. Whether two fishermen jointly carve out a partnership boat, or whether one furnishes

the capital and the other the labor, the boat is not "distributed"; but the ownership of it is, and presumably according to economic principles. So there may often be distribution of property more or less than commensurate with the distribution of wealth; and it is the distribution of property which, in fact, most concerns the economist.

A great deal has been written about this subject of private property. The world is filling with people, and it is filling with good things which these people like and want. Shall the people as a body own the goods in a lump, or shall the ownership and enjoyment of the goods be divided among the human beings in proportion to the ability of each to get hold of them by hard work, or skillful work, or monopoly, or trickery, or any good or bad superiority which helps to constitute him one of the "fittest" and most likely to survive in such a contest? Shall even the planet itself, crowding with the less fit, be parceled out among these good and bad "fittest"? Can there be a more momentous question than this? Can there be one which more deeply concerns the economist as such? On the very day on which I write, four men are to hang for committing murder in answer to this question. The mere presence in the community of a considerable and clamorous element which denies the right of property has its grave economic effects, and hence is a matter of great moment to the economist. Hanging four men, or a hundred men, will not silence that element.

This, however, is not the only aspect of the question that concerns us, though most writers seem to have thought so. The orthodox have been content to prove, or perhaps only assert, that the right of property is the greatest of all the stimuli to labor and frugality, just as Proudhon, on the other hand, was content to show that property is robbery. If any distinction has been made as to the comparative validity of titles to different kinds of property, it has usually been thought sufficient to distinguish between owning the earth and owning its products. But it is not so simple a matter as this. Our great danger is not the theoretical denial of the right of property in general. We are daily called upon to defend it against attack in detail. Bastiat saw this half a century ago, when he was in the thick of the hottest battle that has ever raged about the citadel of property. And now that the contest has broken out in that quarter again, and under the inspiration of being interrupted in the midst of this very sentence by a bulletin announcing that the condemned anarchists have just been hanged, it would be easy to write a book from the following text, which is to be found in the eighth chapter of the "Harmonies of Economics":

"A mere theoretical war against property is by no means the

most virulent or the most dangerous. Since the beginning of the world there has existed a practical conspiracy against it which is not likely soon to cease. War, slavery. imposture, oppressive imposts, monopolies, privileges, commercial frauds, colonies, right to employment, right to credit, right to assistance, right to instruction, progressive taxation imposed in direct or inverse proportion to our power of bearing it, are so many battering-rams directed against the tottering edifice; and if the truth must come out, would you tell me whether there are many men in France, even among those who think themselves conservative, who do not, in one form or another, lend a hand to this work of destruction?"

In America, at the present time, this interminable war on the instinct and institution of private property has taken on all these forms, and many more, which will be treated of in their proper places. The four anarchists, who are at this moment hanging by their necks, were in the van of the procession. When we carefully study the relation of all these doctrines to the antiquated notion of a sacred and absolute right of private property, those who openly deny the right of property in land, as being itself a denial of property in the products of labor, are seen to be far toward the rear. To that study let us now devote our attention; and, in order that it may be a scientific and not a partisan study, we must not let private ownership be to us for the nonce either a fetich or a bugbear. We must analyze it dispassionately, as if it concerned us only as a matter of curiosity, though, in fact, our analysis will show that it is in all respects our chief concern. And we must not neglect to note the economic consequences of its being to us and to our fellow-beings a fetich on the one hand, or on the other a bugbear.

What is property? We have said it is not wealth; but that is not saying what it is. We have said it is ownership, but a synonym is not a definition. What constitutes ownership? What is the exact meaning of the words *mine* and *thine*, in the sense of ownership? There is none. Few words are more indefinite in their meaning. There are degrees of mineness and thineness. These apply respectively to different communities at different periods of their history, and to different subjects of property at the same period and in the same community. Thus there have been times and places in which the phrase "my wife" expressed a property relation. The phrase is still everywhere used, but not in the same sense of property. And yet it seems that among us a man has property in his wife's affections, for he has an action for damages against the man who "alienates" them. Yesterday I received a copy of an interesting paper, read before the American Water-Works Association, under the title "Is Water Property?" This question of what is and what is not ownership or property

is one with which the courts of Christendom are engaged in an interminable wrestle. Their anxiety shows that they regard the settlement of that question in any particular case as a great point gained one way or the other.

I have said that property is a right to something. It is rather, as Macleod says, "an aggregate or bundle of rights." This aggregate is not the same for all classes of property. Hence in order to define property we must classify it. Before attempting this, let us inquire how it comes about that there is such an institution existing among men. We can all feel, if we can not formulate, a definition which will suffice for this purpose. I do not exactly know the limits of my property-rights, nor which of the rights that I have to-day may be taken away from me to-morrow, but I am severely conscious of the fact that I am chiefly occupied in a struggle to make that mine to-morrow which is not mine to-day, and I want to know how I came to be engaged in this struggle; how the universe happens to be divided into the mine and the not-mine; and by what warrant the one is transmuted into the other?

I know of but one economist who introduces the science of political economy by founding it upon the right of property. The late Prof. J. M. Sturtevant begins his text-book of "Economics" in this wise:

"The science we are about to expound is the logical development and application to a special group of phenomena, of a single law of nature, as truly as physical astronomy is the logical development and application to the phenomena of the solar system, of the law of gravitation. The law of nature to which we refer may be thus enunciated:

"*Every man owns himself, and all which he produces by the voluntary exertion of his own powers.*

"Every science must assume something. Ours must assume that the idea of ownership is perfectly clear and intelligible to every one. It is a simple intuition, which originates in the spontaneous action of every human mind, and is therefore indefinable. It ranks in this respect with the idea of personality of moral obligation and of causation."

This statement of the case must be rejected. Property may be universal among human beings, though this is extremely doubtful. But certainly the idea is not clear and intelligible to every one. It would be nearer the truth to say that it is not yet clear to any one. Even the notion that every man owns himself is not universal. A great many human beings are still owned by masters, and millions more by their kings. The conscripted soldiers of Europe do not own themselves. They are owned by the state. And this ownership by the state, by a king, by a slaveholder, is

considered perfectly normal in the communities where it prevails. I have heard it preached from a Northern pulpit that denial to the Southern black of the right of property in himself was a divine institution. The assertion of that right, and of the idea which Prof. Sturtevant calls a "simple intuition, originating in the spontaneous action of every human mind," drove many of the stronger abolitionists into open rejection of the sacred writings of Christianity, which nowhere furnished them a text for their side of the argument. The poorest slave may own something, but he does not own himself.

Neither does every man, in any community, own all the products of his voluntary efforts. Wage-workers never do. They are increasing in proportionate numbers. Hence the second part of the assumed law of nature on which it is proposed to rest the whole science of political economy is less and less true every year, and the whole present progress of civilization is away from it. The belief that it *ought* to be true is the foundation of the creed of those anarchists who have just been hanged, and of those who mourn them. "Labor produces all the wealth, and labor ought to own it," is their familiar cry. Since few things are produced by the efforts of single-handed men; since, as I have shown in the second paper of this series, nearly all production is by combination—ownership of product by producers, if it is to be universal and complete, must also be in combination, or, as we say, in common. This is the straight road to communism, and the first guide-board on the way is this doctrine that property in anything springs certainly and exclusively from effort expended in its production. Yet it is a doctrine which has often been laid down by the most conservative economists and philosophers. Locke stated it two hundred years ago in these terms: "Whatsoever, then, he removes out of the state that Nature hath provided, and left it in, he hath mixed his labor with it, and joined to it something that is his own, and thereby makes it his property." McCulloch says,* "All have been impressed with the reasonableness of the maxim which teaches that the produce of a man's labor and the work of his hands are exclusively his own."

So Laveleye† says that "property in all the fruits of his work must be guaranteed to the worker." Bonamy Price‡ is equally emphatic: "I made it and it is mine, is a sentiment which asserts property in every human soul." Imagine the navvies who build a railroad saying this! And Herbert Spencer* even informs us that, "from the beginning, things identified as products of a man's

* "Principles of Political Economy," chap. ii, section 1.
† "Elements of Political Economy," chap. iii, section 9.
‡ "Practical Political Economy," chap. vi.
* "Principles of Sociology," section 541.

own labor are recognized as his." On the island where Mr. Spencer lives, we might say that almost from the beginning the product, and part of the time both producer and product, have been recognized as belonging to the lord of the manor. At present the bulk of the products belong to the lords of the factories—the "captains of industry"—and nobody but the socialist fails to recognize both the fact and its propriety.

So in the first chapter of Dr. Chapin's recast of Wayland's "Political Economy" we find it stated, as the third of the fundamental principles of the science, that "the exertion of labor establishes a right of property in the fruits of labor, and the idea of exclusive possession is a necessary consequence." And Mark Hopkins, in his "Law of Love" (chapter iii), says that "with no right to the product of his labor, no man would make a tool or a garment, or build a shelter, or raise a crop. There could be no industry and no progress."

Now we must accept or reject the theory supported by this formidable and indefinitely extensible array of authority, because it does or does not conform to the facts; not because it leads to the conclusion that property ought to keep even pace with production in its development toward communism; not because it justifies some in opposing property in land on the ground that land is not a product of labor; not because it leads Prof. Perry and his school into confusion in their effort to prove that property in land is right because the value of land *is* the product of the labor of its owner. If production confers on the producer the divine or otherwise particularly sacred right of property in the product, I propose to accept the truth as soon as convinced of it, whatever agreeable or disagreeable conclusions it may lead to. I do not know that there is any absolute and infallible criterion of truth or reality. Perhaps "persistence in consciousness" may be one. But, at any rate, I have lived long enough to know that "agreeableness" is not."

The fact known to everybody is that the vast army of those who work for wages or salaries do not acquire the slightest proprietary interest in the particular things with which they "mix their labor." Neither do the transportation companies nor the draymen of the streets. It may be said, in defense of the theory, that their interest is bought off in advance, or that, having sold their labor, it is no longer theirs, but does, in fact, belong to the owner of the product.

But this is not the statement of the economists and philosophers we have quoted, and would slur over the laws by which the rate of pay for salaried services is governed. It is much less confusing and more rational to look at the matter as the great majority of people look at it—as all look at it, in fact, until they are

influenced by the labor agitators, who base their arguments on the unguarded utterances of the great thinkers quoted above.

It is all as plain as day. What the wage-worker acquires by his work is not a proprietary interest in the thing he has worked on, but a right of action against the person who employed him to work on it. It is not a *jus in re*, but a *jus in personam*. It is a claim against his employer. It is not a claim for any particular chattel or product, but for legal-tender money of a certain total amount. This amount is determined, not, or at any rate not directly, by the value of the thing produced, nor yet by the value that his work added to it, but by the demand and supply of his kind of labor. The legal claim itself is a subject of property. It can be bought and sold. The community stands ready to enforce it, and thus gives it all its value. Property in this claim, or right of action at law, is just as truly property as is property in the material product, and it is often more reliable; for it lives on, even though the capitalist's property in his factory and its unsold products is wholly destroyed by fire, or its value partially destroyed by a tumble in the market.

The theory we started out to combat consists, in fact, of four propositions, and we have refuted three of them. We have proved that it is not true that every man owns himself; that it is not true that every man owns his products, or the things with which he has mixed his labor, nor that he gets thereby any proprietary interest in them; and that not the affirmative but the negative of these propositions has been most generally accepted by mankind as the true and natural state of the case. So much for what *is*. It remains to inquire what *ought* to be? What would be absolute justice in the matter? Would it be universal private ownership of self and of the products of the labor of one's self? To any such question as this there are three possible answers. There is the answer "Yes," there is the answer "No," and there is the answer that it makes no practical difference what is absolutely just, since absolute justice is unattainable or undesirable. If justice, like perpetual motion, is beyond our reach, the most economical thing to do is to find that out and cease to hope and struggle for it. Meantime economy of motion or of force is an approach toward perpetual motion, and so we may find something, or conclude we want nothing, that will be an approach toward absolute justice.

Now, justice, like property, is an undefined, and quite likely undefinable, term. Our ideas of it change from age to age. It is related to the term and the thing "equality," and this we can all understand. When it is said that two things equal each other, we know exactly what is meant. The proposition that all men ought to be equally rich and happy is perfectly clear. That would be absolute equality. The idea of justice bears about the same rela-

tion to equality that the mathematical statement of a proportion does to that of a simple equation. We may say it would be absolute justice for all men to be rich and happy in proportion to their deserts, whatever that last word may mean; perhaps it would mean that they ought to be rich and happy in proportion to the *pains* of the work they do, perhaps in proportion to its *results*.

The former seems to me to be the true meaning. If there be such a thing as deserving, it seems to me that the woman who heroically wears herself out as a half-hand deserves more than the man by her side who does a hand's work with ease and pleasure—supposing, of course, that they have both previously made the same heroic efforts to acquire skill and efficiency. Absolute justice, if there were such a thing, would give her several times his wages. But could society afford thus to reward people in proportion to their incurable incompetency? If we say "No," then we decide that absolute justice is undesirable at the present stage of evolution. It can be desirable only under the condition of a perfect equality of gifts; and since this condition is most nearly approached by the lowest savages, we are almost forced to the conclusion that absolute justice is a thing to be avoided rather than courted—at any rate, for the present, and until the course of evolution (or progressive creation) is changed. Such seems to be the real view of everybody, whether he has thought little or much upon the subject; and yet everybody denies it, and claims to be in favor of absolute justice, or the nearest possible approach to it. Nay, and he is sincere in his claim. The difference between what people believe and what they think they believe is always important, but nowhere more so than in this study of political economy.

Any system of private property which bestows its blessings in proportion to efficiency in work and management, is unjust to the man who, with a heroic disposition to do his best, is held down, by circumstances over which he has no control, to a life of hard work and little pay. That those who get the least pay have the most irksome work is notoriously not the exception, but the rule. But this is an injustice which it would be fatal to the very life of society to mend, even if it could be done. We can never estimate relative irksomeness; and, if we could, it would be fatal to put a premium on the incapacity which makes the task irksome. Capacity to work and inclination to work are both important. Both must be developed. Nature's way of doing this was gradually to develop in the human mind the institution of property, as we have it to-day. She planted it there long before any of her creatures ever thought of asking why or how or with what probable result; and she planted it deep, and nurtured its roots to deeper and deeper growth. And she planted by its side a restless long-

ing for something we call justice. Both were, and both still are, blind sentiments, working out Nature's "plans" as involuntarily as do our breathing or loving. Our ideas alike of justice and of the right of private property correspond to the age and community in which we live. They may never coincide. At present they do not, in any mind with which I have come in contact.

And yet we must take account of both of them, or lose our reckoning. We shall find among the causes which have contributed to that confusion of ideas regarding the right of property which now confronts and perplexes us, in all our legislation, as well as in our pursuit of theoretical knowledge, the following:

1. That the origin of the right of property is not one, but several. Ownership of self arose in one way, of means of sustenance in another, of land in another, and of fellow-beings in another.

2. That most writers have failed to draw the line between *possession* maintained by force, or not subject to contest, and *ownership* which depends absolutely on the recognition by our fellow-beings of our right to the things we call our own. As is remarked by T. E. Cliffe Leslie, in his introduction to Laveleye's "Primitive Property":

"No mere psychological explanation of the origin of property is, I venture to affirm, admissible, though writers of great authority have attempted to discover its germs by that process in the lower animals. A dog, it has been said, shows an elementary proprietary sentiment when he hides a bone, or keeps watch over his master's goods. But property has not its root in the love of possession. All living beings like and desire certain things, and, if Nature has armed them with any weapons, are prone to use them in order to get and keep what they want. What requires explanation is not the want or desire of certain things on the part of individuals, but the fact that other individuals, with similar wants and desires, should leave them in undisturbed possession, or allot to them a share, of such things. It is the conduct of the community, not the inclination of individuals, that needs investigation. The mere desire for particular articles, so far from accounting for settled and peaceful ownership, tends in the opposite direction, namely, to conflict and the right of the strongest. No small amount of error in several departments of social philosophy, and especially in political economy, has arisen from reasoning from the desires of the individual, instead of from the history of the community."

This is one of the profoundest observations ever made on the subject under consideration. The error to which it is an answer is shared by so great an authority as Herbert Spencer, and repeated in his "Principles of Sociology" (section 536).

"The fact referred to in § 292, that even intelligent animals display a sense of proprietorship, negatives the belief propounded by some, that individual property was not recognized by primitive men. When we see the claim of exclusive possession understood by a dog, so that he fights in defense of his master's clothes if left in charge of them, it becomes impossible to suppose that even in their lowest state men were devoid of those ideas and emotions which initiate private ownership. All that may be fairly assumed is that these ideas and sentiments were at first less developed than they have since become."

And again (section 541), Mr. Spencer says:

"The desire to appropriate, and to keep that which has been appropriated, lies deep, not in human nature only, but in animal nature: being, indeed, a condition to survival."

Nevertheless, individual ownership does not prevail among the social insects, and yet their industry and frugality have been, even from Bible times, held up as a lesson for man. "Go to the ant, thou sluggard," and learn among other things that animals, unlike men, may be aroused to intense and untiring activity and close frugality by purely social instincts, their own sustenance being swallowed up in social sustenance.

In the following passage from the same section, Mr. Spencer reaches, only to drop it, the point insisted on by Mr. Leslie:

"The consciousness that conflict, and consequent injury, may probably result from the endeavor to take that which is held by another, ever tends to establish and strengthen the custom of leaving each in possession of whatever he has obtained by labor; and this custom takes among primitive men the shape of an overtly-admitted claim."

Perhaps this explains also the custom of leaving each in possession of what he obtains without labor. At any rate, the claim to ownership comes to be admitted, and then only *is* it ownership or property, whether founded on participation in production or, as Lieber ("Property and Labor") insists, on appropriation or what not.

PROF. JOSEPH LE CONTE has suggested that the custom of deducing the relative mortality from different diseases by comparison with the total mortality, instead of the number of persons still living, is liable to lead to erroneous conclusions. Even estimates of general mortality by comparing the total annual deaths with the number of persons at all ages may mislead. Thus the apparent low rate of mortality in San Francisco as compared with Eastern cities arises from the abnormal proportion of adults to children there, and not from general conditions unusually favorable to health. The true coefficient of mortality from cholera infantum is expressed by the ratio of the number of deaths from the disease to the number of persons liable to be attacked by it—or to the number of children under three years of age.

ARCTIC ICE AND ITS NAVIGATION.

By ALBERT A. ACKERMAN,
ENSIGN, UNITED STATES NAVY.

FEW people can understand the fascination of summer life in the arctic regions for those who have once gone through the experience without disaster.

It is an awe-inspiring land. The massive, dreamy beauty of the slumbering icebergs, the sharp outlines and sheer height of the basalt coast cliffs, the mysterious expanse of the glacier, and the ceaseless motion of the ice-floes grinding and clashing together, produce upon all men emotions of awe and delight.

Elsewhere, Nature moves as well with power and grandeur, but more slowly and with much less amplitude of action; there, the changes that in a temperate climate require months take place tumultuously in a few days.

The breaking up and floating away of the ice-field, the *débâcle* of the glaciers and disgorging of the fiords, impress man with his utter insignificance and weakness in the presence of such mighty forces. Fleets of lofty icebergs drift southward, urged on by deep under-currents, and plow their way through thinner ice, splitting, colliding, and overturning, always maintaining a certain sphinx-like dignity—majestic and mysterious. Vast outreaching tongues of ice extend from their hidden bases, as hard as rock and as dangerous to the unwary navigator, while to leeward drifts a convoy of smaller bergs, the *débris* of the first—a jostling following too rough for safe companionship. Over all this glistening mass of marble white hover myriads of white gulls, and in the blue translucent caverns at the water's edge reverberate the swash of the sea and the music of cascades.

Amid such surroundings men can test themselves, where the brave have confessed fear and the hardy and strong confessed weakness; and so long as men are brave and strong, so will there be volunteers for expeditions, the northern limit of which depends alone upon the extent to which fortune favors their strength and judgment. Arctic exploration is not dependent, however, upon the vanity of adventurers; the world throngs with eager students of Nature, and from these must spring the motive which alone can lead to success. Rarely does it happen that robust health and love of adventure accompany the knowledge of generalization only acquired by years of study, and so essential in localities where there is little that is familiar and unworthy of record; to this, and not only to the disasters from which hardly an expedition has escaped, is due the fact that, notwithstanding the treas-

ure expended in arctic exploration, so little is known and so many of the popular ideas are erroneous.

Most arctic travelers will agree in saying that careful study of all the works on the subject will form but a meager preparation for a prospective explorer. It is a new world; impressions are so strange and vivid that no fixed plan of description will suffice.

In the narrow Greenland waters each successive headland, island, or mountain stands as the mark of farthest progress and blasted hopes of brave old-time navigators. Can anything be more pathetic than the quaint log-book of that stanch old seaman, Captain John Davis, with its account of protracted struggles and final disappointment? He sailed in the time of Raleigh and Blake. Now, but a few miles beyond a black, ram-shaped cape, that he named Sanderson's Hoop, lies the Danish trading-post of Upernavik, and every summer ten powerful steam whalers smash through the ice, which at this point turned back his small sailing vessels. For hundreds of years, dating back to the time of Davis and Frobisher, the art of ice navigation has been constantly improving, until now it is a very rare thing for either a Dundee whaler or a St. John sealer to meet with serious disaster while pursuing its legitimate calling.

With our own Bering Sea whalers the case is different—there are important differences between the ice encountered in Greenland waters and that north of Alaska. A description of the circumstances affecting the formation of the various kinds of berg and floe ice will make this clear.

The natural form of an iceberg is a regular prism, broken from the face of the glacier as its onward motion forces it down along the bottom of the inclosing fiord, by the buoyant action of the water. Through the tides the upward pressure of the water varies constantly, and has much to do with the production of internal strains and fissures, which form planes of cleavage parallel to the face of the glacier; one of these ultimately marks the boundary of the berg, the others are weak spots which may develop afterward. Where glaciers approach the sea at a steep grade, they move more rapidly, are subjected to greater stresses, there is less opportunity for the exhibition of the viscous property of ice at the freezing-point, *débâcles* occur more frequently, and the bergs are smaller and more irregular. Under such conditions the ice is full of partly cemented cracks and curved fissures, so that in a short time water-markings, ice-scorings and scratches, and the melting of snow-spots, produce the most fantastic and airy shapes. More durable than clouds, they still rival them in variety of design and change of form, as successive beauties are revealed in passing. Apparently free from all the requisitions of

equilibrium, owing to the preponderance of the part submerged, bold spurs and flying arches spring from their walls, and hanging balconies ornament their crests.

In Greenland, as in the antarctic, there is either a great continent or a congeries of islands, covered with an ice-field of such gradual inclination through great distance that the movement of its face is very slow, and the *débâcles* and avalanches occur less frequently, so that the bergs are of enormous size and regular shape, having a height of from one to two hundred feet in the northern and three hundred feet in the southern hemisphere. The Alaskan glaciers are of comparatively small extent, the ice-field of which the Muir and Davidson glaciers are spurs being only four hundred miles wide; owing to the inclination of their containing valleys, they move with great rapidity, *débâcles* are occurring continually; the bergs, falling into shallow water, quickly go to pieces, and the fragments which at last escape through the intricacies of fiords and archipelagoes are very small. In addition, the comparatively shallow water along the coast of Siberia prevents floe-bergs of any great size passing through Bering Strait, while a seventeen-fathom bank, north of Wrangell Island, bars the way to all rectangular bergs over twenty-three fathoms thick that have drifted across the arctic. In this way it happens that the Bering Sea whalers never see the great icebergs which play so important a part in the navigation of those in Greenland waters.

Perhaps the continual excitement in the confined waters of the latter land, and the natural desire to classify the new and mysterious with the old and commonplace, make the mind quick to see resemblances. However that may be, the bergs seem subject to some laws of form. Capitals, sphinxes, castles, and cathedrals are frequently met with; at times, whole menageries would troop past—lions couchant, mushrooms, and flowers occur in profusion—the small fragments of ice, through the washing of water and scoring of surrounding floes, showing a greater variety of forms than the large bergs.

On the east side of Melville Bay in north Greenland is a headland called, from its peculiar shape, "The Devil's Thumb." It is a remarkable column, resembling a closed hand with the thumb projecting upward, and bears stout testimony to the toughness of the granite composing it, which has withstood in this sharp outline all the disintegrating forces of that climate for centuries. It is about seven hundred feet high. In June, 1884, a photograph was taken of a very lofty iceberg, grounded in its vicinity, which was an almost perfect representation of a hand and wrist, the index-finger pointing heavenward. A connection between the black, time-stained Devil's Thumb and this beautiful marble-like shaft

was at once made in the minds of every one present, and the iceberg was named "The Hand of Providence."

The pack ice of one winter's growth is met and fought by the whalers on both sides of the continent, until, with the assistance of the summer sun, it is conquered, and no longer forms an obstacle to progress northward.

Hayes states that the formation of new ice in Foulk Fiord during one winter in still water was thirteen feet thick. It is highly improbable that any additions at that depth would be made during even extraordinary cold periods; it has since been surmised by experienced arctic travelers that a portion of this thickness was due to snow deposits. Ordinarily, this ice will not be found thicker than seven feet. Early in summer it breaks up and floats away in immense floes as pack ice; sometimes, through pressure, becoming hummocked or piled in thicknesses of three or four fold into the size of small bergs or crushed into fragments, until it finally melts out of sight away to the southward. This ice can be distinguished, even when hummocked, from that formed by broken-up bergs by its opaque-white color, due to the presence of innumerable air-cells, its method of formation rendering it softer and more porous than glacier ice, which is subjected to years of pressure and concentration through infiltrating streams of freezing water.

Before the immense floes are broken up, however, they are extremely dangerous in the confined Greenland waters, where they are continually subjected to terrible pressures by the winds and surface currents. The eastern whalers, through superior equipment and working in company, escape many of the disasters of the Americans in the Pacific, while their proximity to land or fast ice and numerous villages of Eskimos gives them strong hopes of rescue, even though their vessel may be lost. After arriving at their station they have little to fear but floating bergs and hummocks, their powerful steamers crushing the then rotten floe ice with ease. As the whales leave the vicinity of Pond's Inlet early in the summer, the whalers strive to get there as quickly as possible; a large reward being often given by the owners to the crew of the vessel first reaching that point. They can afford this, as her cargo may consist largely of whalebone collected by the Eskimos in the vicinity. These men are, in consequence, the best ice-navigators in the world.

Our own American whalers have no such incentive; they are no less hardy or brave than any seamen in the world. Their life is a hard one; in case of disaster, there is no such way of escape as that open to the Scotchmen in the east; and yet it would be comparatively easy to establish a life-saving station on the north coast of Alaska, which would repay perhaps more than any other

on our coasts. There is but one narrow passage for the Bering floes, and the ice after passing through the strait scatters and becomes easier to avoid. The pack is not confined and caused to revolve between immense icebergs or many narrow passages, as in Greenland or eastern waters, so that the recent employment of steam whalers, instead of the old-time sailing vessels, has been dictated more by a desire for increased profits than by actual necessity.

But there is another and more dangerous ice than floe ice, as it takes many years for its formation. It is met with in isolated floes, but rarely if ever in pack below Smith's Sound, and the Scotch whalers seldom encounter it. Ships have been nipped hundreds of times in floe ice and escaped, but few if any have ever freed themselves from the fierce grasp of the ancient ice of the arctic, called by Nares floe-berg or paleocrystic ice. This bears evidence of great age, the part above water being from fifteen to forty-five feet in thickness, which would make its depth from one hundred and thirty-five to four hundred and five feet; the stoutest-built ship that ever put to sea would be crushed into matchsticks by the pressure of two such floes upon her sides. This ice forms the northern limit of the cruising-grounds of the American whalers north of Alaska. Some years it moves to the southward and closes up on them; again, it recedes, disclosing more of the mystery of the farther north. Scattered here and there through it are *polynias*, or lakes of ice, of one year's growth, inclosed by heavy floes arched and keyed together.

Paleocrystic ice is old pack ice built up by successive deposits of snow during a long period of time, thus giving it an appearance of stratification. There is an alternation of soft white and hard blue ice, representing, respectively, compressed snow and water formed during the sunshine by thaws, and frozen at night or when cloudy. (It is a remarkable fact that snow will melt and seep through floe ice in sunlight though the thermometer may record far below the freezing-point.) Eventually, during the long summer day, the floe is left bare and dry, but soft and porous, unless so far north that the snow-storms continue all the year round. Over some strata are layers of atmospheric dust, such as Nordenskiöld found on the Greenland glaciers; also the gradual decrease of the thickness of the layers—due to pressure and increase of blue ice—because of greater infiltration, as the lower part of the berg is approached, make certain the progressive nature of the formation.

Beyond the Melville Bay pack, averaging six feet in thickness, lies the "north water" of the whalers, corresponding to the open space usually found between the paleocrystic pack and Bering Strait. This is dotted with hummocks, rubble ice, or broken-up

bergs, and icebergs of enormous size, which it is easy to avoid except in the frequent fogs of the summer months. These icebergs break from the immense glaciers bounding Melville Bay and Kennedy Channel, which occasionally rise two hundred feet above the water. It is apparent that the bergs breaking off irregularly might, through a bulky form of the submerged part, attain a still greater height. Hayes mentions a berg over three hundred feet high in the "north water"; the Proteus on her last trip sighted one a hundred and fifty feet high, six miles long, and a little more than a mile wide. These immense bergs are most important agents in breaking up the ice-fields in early spring, for, being propelled by deep under-currents, their motion is often contrary to that of the floe ice moved by the wind and surface currents.

The wind also plays an important part, a southwest gale sending the packs and hummocks upon the edge of the fast or land ice, and crushing it for some distance, after which any northerly wind disengages the free ice, leaving an open space, called the inshore lead, which the earliest whalers always follow. It is, of course, dangerous, as a south wind sends the pack back, and imprisons if it does not crush them. In July the quicker way through "the middle passage" of the Melville Bay pack is used, as the ice is then comparatively harmless, although vessels are sometimes nipped and rather severely handled.

No stronger vessels than those of the Dundee whalers are built; they are from four hundred to one thousand tons displacement, have powerful, well-secured engines to resist the shock of ramming or stoppage of the propeller by ice, and are built with an eye to the easy and rapid replacement of rudder, propeller, and propeller-shaft if damaged, these parts being carried in duplicate. Above all other considerations, they possess strength for ramming as well as resistance to lateral pressure when nipped.

Another very important feature is that the bow shall have considerable inclination, which permits the vessel, when ramming very heavy ice, to lift slightly and slide on it, thus easing the shock and assisting the cutting action of the bow with the downward crushing weight of the ship. In this way it is possible for these steamers at full speed to ram ice over twenty feet thick, and receive no immediate incapacitating damage.

If the ice is not too heavy, the shear-like rise and fall of the bow is repeated several times as the vessel steams powerfully ahead until her headway is checked. The difficulty then is to extract the ship from the dock she has cut by her advance: the floes press on her sides, cakes of ice and slush fill her wake, and there is nothing but the ice-hampered propeller with which to overcome her inertia and draw back out of the nip. Frequently this is insufficient, and the ship may be crushed.

In breaking up a floe of great extent and thickness, which is rarely attempted, as the coal and labor thus expended might be saved by a movement of the ice in a few hours, two vessels work to great advantage in concert, striking alternate blows at an angle with each other, thus breaking off wedge-shaped sections, which are shoved out of the way as fast as an advance is made into the floe.

Various other methods are employed for breaking a way through the ice or relieving the pressure on the ship, but they are all insignificant compared with the mighty results of dashing and fearless ramming. Without it, in spite of the utmost exertions of officers and men, Greely would not have been rescued. The dispersive effect of explosives in water-soaked ice is small, and placing the torpedoes requires time; the ice-saw is clumsy, slow, and rapidly exhausts an already overwrought crew, while warping and towing floes are but the last safeguards from despair.

The Dundee skippers are not held to too strict account for damages that the vessels may sustain during their short but exciting cruise. Desperate risks are taken every day; the man who fears responsibility would never succeed, while another hesitating or lacking resource would quickly lose his ship. Starting from Dundee in April, they generally reach Godhavn, in latitude 69° 15′ north, before June, but from that point to their destination it is a long and plucky fight with the ice. Continually following up the breaches made in the solid field by storms and tides, their only fear, though surrounded by floes capable of crushing the ships if taken unawares, is that the lead will open in some other place, leaving them inclosed by vast immovable floes until some rare northwest wind loosens the pack, or the summer's sun so weakens it that the ship is able to smash through and escape.

On the approach of a gale, when the ice may be expected to move rapidly and through its great weight and extent accumulate pressure, a fine solid floe is selected in which to form a protected dock. In it the ship is rammed as far as possible, if necessary the slip being deepened with the ice-saw; so long as the floe holds together the ship will be subjected to the pressure of only those small fragments that may be forced into the entrance to the dock.

To take advantage of every little patch of open water in breaking through the pack, a pilot is stationed aloft in the "crow's nest"; this is a large cask, with a trap-door in the bottom for entrance, secured to the mast. It is sometimes quite cozy, being fitted with a wind-screen, rest for the long glass, engine-room bell pull or indicator, helm-director, and compass. The height of the observer is about one hundred and fifteen feet, and the greatest distance at which ordinary pack ice is visible from that height is less than seven miles; it is evident, then, how much experience and

judgment are necessary in directing the movements of the ship, the only indications at times being doubtful ice-blinks and undecided water-skies.

The ice-blink is frequently a very weak indication in summer, appearing as a narrow belt of a little lighter and yellowish sky just above the horizon. So faint is its appearance at times that it would not be recognized except by comparison with known water-sky. The latter is dark and gloomy, much resembling that preceding a thunder-storm.

In the pack itself it is generally calm, a slight breeze being almost certain evidence of the close proximity of considerable open water.

The sealers of Dundee and St. John, Newfoundland, rendezvous at the latter port and start almost in the same half-hour about midnight of some day in March. The date is fixed by law, in order to protect the seals during their bearing period. They have a less venturesome voyage than the whalers, though starting earlier, their hope being to meet the first great ice-floes in the open sea where they are subjected to very little pressure, though the fogs and dark nights make it difficult to avoid collision with one of the numerous icebergs.

The sealers depend in a great measure on luck to strike the floes on which the hair-seal is found in great numbers; a few of the oldest captains are supposed to possess a prescience or peculiar judgment, though it is by no means certain that the seals will be met with in the same part of the open sea in two consecutive seasons. In fact, out of ten or twelve sealers leaving in the same hour every year, it frequently happens that one or two of the luckiest have made two successful trips with full cargoes before some of the others have reported more or less bad luck from their first; the Proteus once brought in one hundred thousand skins from her first trip of the season alone.

On sighting the ice the steamers run along the great floes and through the leads until they find a floe on which a colony of seals have congregated; a dock is rammed into the ice at once; ice anchors are laid out ahead; the very large crew carried is landed by the Jacob's ladders dangling from the head-booms. Sometimes the crew is split up into several parties to work on different floes; in all cases the seals are surrounded as rapidly as possible and driven toward a common center. Here they crawl up on each other, barking and moaning, until they form a great heap ten feet or more in height, writhing and fighting, while the ice in every direction is dotted with the white puppy-seals so young as to be unable to move. The men at work on the ice esteem very highly the frozen hearts of these young seals, claiming that they are not only palatable, but enable them to better stand cold and fatigue.

The seals having been concentrated, the work of slaughter commences: each man is armed with a pole having a hook attached to one end, with which the seals are one by one drawn from the pile and killed by a single blow on the head. The skin is then quickly removed with the fat blubber, which is wrapped up in it; it is valueless as fur, and eventually tanned, split, and made up as imitation kid into gloves, linings of porte-monnaies, valises, shoes, etc.

In less than two months after the sealers first start out, the seals have completely disappeared; where they go is a mystery. In the fall they reappear in small groups making their way north again.

The whaling season then follows immediately after the sealing, the same steamers sometimes being employed.

Early in September, whether the season has been successful or not, the Dundee whalers start on their return voyage, following the east coast of British America and Labrador until they lose the benefit of the polar current near Newfoundland.

It is a rough trip; gales and tremendous seas are peculiar to both time of year and locality, yet it may be considered almost uneventful to the crews of those racked and bruised vessels which will require the whole winter to refit for next season's work.

A CORNER OF THE DUTCH EAST INDIES.

By Captain G. LANGEN.

THE Key or Ké Islands of the Dutch East Indies derive their name from a native word signifying "What do you say?" The native tradition runs that when Macassar traders first landed there and inquired in the Malay tongue after the name of the land they had set foot on, the natives answered, "Kay," and this expression was mistaken by the questioners for the name of the islands. The group consists of two larger islands, of which the westerly one bears the name of Nuhu-roa, or Little Key, and the easterly one Ju-ud, or Great Key, with a number of smaller islands around them. Great Key is undoubtedly geologically much older than Little Key and the other surrounding islands, and possesses elevations of from two thousand to three thousand feet, while Little Key and the other islands are very low. Great Key is principally of a rocky and volcanic formation; Little Key and the surrounding islands are formed of coral and interveined by flint and quartz. Little Key, according to the most reliable chiefs, was raised out of the sea about thirty-five years ago, during the

shocks of a severe earthquake attended by a tidal wave; after which no earthquakes occurred till April, 1884.

Every island belonging to the group is covered, down to the water's edge, with dense tropical jungle, with gigantic creepers winding from one tree to another so as to form a close network. These forests contain choice kinds of timber, the inducements offered by which have provoked the establishment of the present German colony. The southwest monsoon, which blows during our winter months, brings abundant rains; and the occasional showers of April, with the heavy dews of June, July, and August, keep the ground moist and afford ample nourishment to vegetation. In October and November, the hottest months, vegetation suffers from drought. The rain percolates through the soil quickly to the coral. The traveler will, therefore, meet with only a few pieces of marshy soil on the islands; but he is astonished at the luxuriant growth of vegetation, at the gigantic and stately trees spreading their roots to seek a firm hold around the coral, out of whose porous texture their fibers obtain nourishment; and no place on the group is entirely barren and destitute of vegetation.

The supply of fresh water is very unevenly distributed, and there are many villages where none is obtainable, and the inhabitants have to go a long distance for it. Generally, the fresh-water wells are situated close by the sea. All the fresh drinking-water contains lime in large quantities, the characteristic effects of which are neutralized by the liberal use of acid fruits. It is evident that the sea, infiltrating gradually through the pores of the coral, becomes purified and separated from all its saline ingredients on its way to the wells; and those places where fresh water is not obtainable are of quartz formation.

The islands are divided into districts, each comprising a number of villages with their surrounding land. Each district has its principal chief, or rajah, and these have in the villages under-chiefs of various ranks. All these offices are hereditary, descending to the eldest sons of the respective families. If there is no successor, a new chief is elected by the natives of the district. A chief receives no payment, but after having been acknowledged and established in office by the Resident of Amboyna, he is presented with a silver mounting for his walking-stick, on which is engraved the Dutch coat of arms. After he has held his office for twenty-five years with faultless conduct and loyalty, the silver mounting on the walking-stick is replaced by a golden one. If a chief has rendered an extraordinarily praiseworthy service to his government, he is presented with a fanciful, richly ornamented umbrella, which his servant carries before him, when he walks abroad, to prevent the sun from tanning his face.

About one third of the population are Mohammedans, and these are increasing every year, through the influence of Arabs and of natives who have returned as *hadjis* from Mecca. These men are worshiped to a certain extent by their inferior-stationed fellow-believers, and exercise such an influence upon them as to be kept for the rest of their lives in food and clothes.

The indigenes of Key are tall, strongly built, having the forehead broad and slanting backward, dark eyes with heavy black lashes, a large but well-shaped nose, high cheek-bones, and broad mouth, with the under lip more or less projecting, black and brown colored beard, and long, wavy, but fine curled black hair, mixed with several lighter or darker shades of brown, reaching to the shoulder and projecting all round the head like a mop. Their skin is rather dark, but of a lighter hue than that of the Papuans of New Guinea. Formerly, their clothing was the same as that used by the Alfueros of Ceram and Borneo; but, since the establishment of the European colony, both their clothing and manner of living have become more elaborate. Mixtures have taken place between some of them and the Papuans of New Guinea, resulting in the formation of a stock which is found in all parts of the islands.

The natives live in huts built on poles of strong and hard timber or thick bamboo; and a very few houses of chiefs are constructed of timber. The huts are built several feet above the ground, for protection against the swarms of vermin that come up during the southwest monsoon, and to secure a free current of air and consequent coolness. The sides of these houses are covered in either by *attap*, which consists of the dried leaves of the sago-palm doubled over a small bamboo about six feet long and laced tightly to it by means of split cane; or with the stems of the same palm-leaf, which, after being drilled and deprived of their thorns, are placed vertically between two boards in such a way that the hollow part of the stem fits tightly over the half-rounded part of the succeeding one. In this way a very light but water-tight outside covering is formed, and gives to the house a not unpleasant appearance, for the dried stems exhibit a brown gloss, as if they were polished. The doorway, in the middle of the front of the house, leads into a spacious room, which represents the reception-room for visitors. On the floor of this room, which is covered with split-bamboo matting of rather wide meshes, are spread out other mats, made of fine grass or bark. Belonging to each mat is a bolster, with a cover of bright calico print, having its ends ornamented with embroidery. From each side of the reception-room are openings leading into the other rooms. These rooms are divided into sitting and bed rooms, and they are adorned with fancy colored boxes made out of palm-leaves, and

having figures worked upon them with differently colored bark and beads of small shells. Placed one upon another, these boxes are good substitutes for cupboards and chests of drawers, while a strong, roughly made timber chest, provided with a clumsy lock of iron or brass, contains the family treasures, jewels, heirlooms, weapons, and emblems. An assemblage of huts or houses forms a village. The villages are surrounded by walls of coral, and are for the most part situated on the sea-shore.

Each village has an allotment of land, the boundaries of which are established by the chiefs. Here the native may fell his timber, cultivate a garden, or cut down the sago-palm, which furnishes his principal food. The cocoanut-trees, however, are regarded as general property, and are under the guardianship of chiefs, without whose orders not a nut may be plucked till harvest-time. Then, on a day appointed for this purpose, the whole village will set out to gather them, when each one will receive a number proportioned to his rank and station.

When a native child is strong enough to assist his parents in their daily occupation, he has to accompany them to the garden, the boat-building yard, or some other place of general work. Children of from three to five years of age may be seen occupied in trying their skill in carving ornamental figures such as are used for the figure-heads of boats, or in cutting out vessels and rigging them, or the boys will assist their fathers at the building of a boat or a house. Although they are without all proper drawing materials, the artistic and constructive talent is almost universally manifested among them. The children are seen trying their skill by drawing, on a smooth, flat surface of fine sand, houses, animals, steam and sailing boats, and I have been always struck by the symmetry of their work. The children are deemed marriageable at fifteen years of age, but arrangements for mating the female children are made as soon as may be after their birth.

When disputes relating to boundaries arise between different villages, each of the quarreling districts elects a person and commits him to the judgment of the god, who, it is believed, will let the party in the wrong die within three months. If no harm befalls either party after the lapse of that time, the land in dispute is divided equally.

The chief talent of the natives is for boat-building. The symmetrical construction of their vessels, large and small, would astonish a European ship-builder, and is the more remarkable as they have nothing but the most roughly shaped tools. All the tools are made by natives of Teor. In nearly every village we find a smith established, who is employed from morning till night melting rusty nails in a charcoal-fire, which is kept burning by means of a primitive pair of bellows moved by the operator's

helpmate. This apparatus consists of two bamboo cylinders, about two feet long, at the bottom of each of which a small bamboo conveys the current of air into a still smaller one, leading into the charcoal-fire. Each of these bamboo cylinders contains a spear of the same material, at the lower end of which are tied bunches of feathers. Generally a native of Key will prefer the rough workmanship of the tools made by the village blacksmith to the finely finished and polished ones imported from Europe.

The natives are largely engaged in felling and selling timber. For felling the trees the woodman uses a wedge-shaped axe only, by which he is able to cut down the largest tree. After lopping off all the branches and bark, he squares the trunk in such a skillful though wasteful manner that, as a rule, the four sides represent exactly the same dimensions. The islands produce large quantities of various kinds of very hard and soft timber, suitable for different branches of building, but the most valued sort is the *bayam*, or New Guinea teak, called by the natives by a Malay word signifying iron-wood, because of its flexibility and durability, and its immunity from the attacks of white ants. Mother-of-pearl shell is found in the bays and inlets, and other valuable shells are plentiful. Tortoise-shell is exported in very small quantity.

On the perpendicular face of a cliff on the northwest coast of Nuhu-roa are to be seen rude native drawings of various shapes and meanings, chiseled in the rock, which appear to have been once filled in with red pigment. It is a marvel how the chiseler could have been suspended over these very steep rocks, so as to be able to engrave the figures. The eye may distinctly perceive such forms as a little sailing boat, a human head, hand, foot, star-fish, tombstones, and many other objects; and it is strange that similar figures are still drawn and painted on various articles in use. Natives, on being questioned about these rock-engravings, answer that they can not account for them, nor were their fathers before them any wiser; but they think that the spirits of the dead suspend themselves over the cliffs at midnight and engrave them. All natives shun the spot, and by no means whatever can they be induced to climb the cliff in order to copy these strange drawings. No native can be persuaded to accompany a European to this spot, where, according to their belief, the spirits hold their meetings. Certain trees are also held sacred, and believed to be the abode of an invisible god, to whom the native offers sacrifice whenever any mishap occurs in his family, or when one of its members leaves home to go over the sea. The sacrifices are made in the following manner: Some cooked sago or rice is wrapped up in a palm-leaf, and, before tying the same with a piece of split cane in the shape of a parcel, the person sacrificing scrapes over

the sago or rice, by means of a knife, file, or any other sharp-edged stone, a little gold-dust off his ornaments. After this has been done, he ties the parcel together and suspends it by means of a split cane from a branch of the sacred tree, under fervent prayers to his god. In some parts of the island the traveler will find these sacred trees, ornamented from top to bottom, like a German Christmas-tree, with these odd-looking palm-leaf parcels. In other parts of the Key group there are still found public places for sacrificing, consisting of a fanciful carved box, elevated on a pole about four or five feet high. The sacrifice is conveyed through a small opening in the box. Some places are shunned by the natives, who prefer walking a long distance out of their direct way, to being obliged to pass the haunted spot where some imaginary Satan and his followers are supposed to hold their meetings.—*Abridged from the Proceedings of the Royal Geographical Society.*

SKETCH OF JOSEPH LOVERING.

A COMPANY of about one hundred and fifty gentlemen distinguished in science and literature sat down a few months ago to a banquet in the Hôtel Vendôme, Boston. The festival was one tendered by his colleagues, classmates, and friends to Prof. Joseph Lovering in honor of the distinction he enjoyed of having served for fifty years as a professor in Harvard College. He was the first professor who held that position for so long a time. Previous to entering upon this office, he had served two years as tutor; and, adding the two terms together, his was the second longest period of consecutive service recorded in the history of the institution. President Eliot presided at the banquet, and the tables were occupied by members of the Board of Overseers, the teaching faculty, and distinguished graduates and friends of the oldest American institution of learning. The speakers were too many to be specified here; and we shall have to be satisfied with saying that their names are associated with what is best in the thought and learning of the period. A similar scene was witnessed in this city at the dinner of the Harvard Club on the 21st of February, 1889, when Prof. Lovering, being a guest, received congratulations.

JOSEPH LOVERING was born in Charlestown, Mass., December 25, 1813. His father was surveyor of ice, wood, and lumber. He attended a grammar school of his native town, and seems there to have outrun the capacity of his teachers; for it is recorded of him that he went through Colburn's Algebra by himself, none of

them having any knowledge of the subject. He was afterward fitted for college under his pastor, the Rev. Dr. James Walker, subsequently Professor and President of Harvard University, to whom he recited daily, entered the sophomore class at Harvard in 1830, and was graduated in 1833. He entered the Divinity School in Cambridge in the fall of 1834, and remained there two years, but was practically employed in teaching almost constantly after graduation: in the first year, in a small private school in Charlestown; in 1834–'35, as assistant to Prof. Peirce in the instruction of the college classes in mathematics; in 1835–'36, as proctor and instructor in mathematics; in 1836–'37, as tutor in mathematics and lecturer in natural philosophy; and from 1838 to 1888, as Hollis Professor of Mathematics and Natural Philosophy. Retiring from this active professorship after fifty years of service, he became, as he still is, Hollis Professor Emeritus. He acted as Regent in 1853–'54 during Prof. Felton's absence in Europe; succeeded to that office in 1857, and held it till 1870; but passed a year's leave of absence—given to him in consideration of his long and uninterrupted services to the college—in 1868–'69, in Europe. When the Jefferson Physical Laboratory was opened in 1884, he was appointed its director, and during the four years of his administration made annual reports of its activities.

While his college duties demanded the largest share of his time and his best thoughts, he found and improved opportunities to make a good record of other work—all for the increase and dissemination of knowledge. Among these extra-collegiate exercises were nine courses, of twelve lectures each, and each lecture delivered to two different audiences in the earlier years, on astronomy and physics, at the Lowell Institute; shorter courses of lectures at the Smithsonian Institution, the Peabody Institute of Baltimore, and the Charitable Mechanics' Institution of Boston; and single lectures in different towns and cities in New England. He edited, in 1842, at the request of the author, a new edition of Farrar's "Electricity and Magnetism." One of his essays on the aurora borealis, in the "Memoirs" of the American Academy of Arts and Sciences, fills a thick quarto volume. Other memoirs, on terrestrial magnetism, the aurora, the determination of transatlantic longitudes, etc., published in the same series, attest the fertility of his researches.

As Permanent Secretary of the American Association for the Advancement of Science, from 1854 to 1873, Prof. Lovering edited fifteen volumes of its "Proceedings." Retiring from this office on being elected President of the Association for 1873, he put upon record that, when he entered upon its duties at the eighth meeting of the Association, the body had an annual income of only a few hundred dollars, and was dependent upon the gener-

osity of the cities where it met for the publication of its "Proceedings." Since that time it had been able to pay all its expenses, had acquired a valuable stock of "Proceedings," and possessed a cash balance amounting (with interest) to more than two thousand dollars. As president of the Portland meeting of 1873, he emphasized, in his reception address, as the one object of the Association, the advancement of science in the United States. "Few of us," he said, "can aspire to the honor of being discoverers of the laws of nature, in the high sense of that phrase. But no one, however humble his capacities, or however limited his opportunities, who labors for science, will fail to advance it and be rewarded by it. We meet together from year to year, the veterans in science, with the younger aspirants for distinction, and many more who long to catch the earliest tidings of the last word which Science has to say in regard to the earth under our feet or the stars above us; a few to speak but many more to listen; but each doing his part to advance science, either by active research or encouraging sympathy. Our brief meetings allow us no leisure to listen to what is old or to what may be read in books, or to glittering generalities, or ingenious speculations on the universe, unsupported by evidence and individual investigation. But any new fact, however microscopic, any new investigation, whether it concerns a planet or an atom, any new experiment in which a law of nature is made more palpable and convincing, finds with us a ready welcome." The members, he added, did not concern themselves with the utility of the truths which were communicated at these meetings. If they had no immediate practical value, it was sufficient for them that they were true and revealed the plans of the Creator. "It is impossible for the man of science to serve two masters, the Kingdom of Nature and Mammon. It is a dangerous thing for him to be thinking of the utility of his discoveries, or of the pecuniary profit which may be made out of them." In his retiring address, in 1874, which was published in the "Monthly" for December, 1874, and January, 1875, Prof. Lovering spoke of "Instruments in Physical Progress" and "Mathematical Investigations in Physics," and sketched the resources and present attitude of the physical sciences. He presented the view that "the great problem of the day is how to subject all physical phenomena to dynamical laws. With all the experimental devices and all the mathematical appliances of this generation, the human mind has been baffled in its attempts to construct a universal science of physics. But nothing will discourage it; when foiled in one direction, it will attack in another. Science is not destructive, but progressive; while its theories change, the facts remain. Its generalizations are widening and deepening from age to age. We may extend to all the theories of physical science the remark

of Grote, which Challis quotes in favor of his own: 'Its fruitfulness is its correctibility.' Instead of being disheartened by difficulties, the true man of science will congratulate himself in the words of Vauvenargues, that he lives in a world fertile in obstacles. Immortality would be no boon if there were not something left to discover as well as to love!"

THE OBSERVATORY OF HARVARD UNIVERSITY.—M. W. C. Bond started a private observatory at his house in Dorchester, where he observed eclipses and occultations, as far back as 1820. In 1840 he was induced by President Quincy to remove to Cambridge with his transit-instrument and other appointments, which were supplemented by some telescopes, sextants, etc., belonging to the college. Prof. Lovering was associated with him in the management of this primitive observatory. Its location was in a private house belonging to the college, in which Mr. Bond and Prof. Lovering took up their residence. Humboldt had induced the Royal Society of London to co-operate in making simultaneous observations on the elements of terrestrial magnetism in Great Britain and its colonies. The only stations on this Western Continent were at Toronto, Canada, and in Philadelphia and Cambridge. Prof. Bache, afterward Chief of the United States Coast Survey, conducted the observations in Philadelphia. Mr. Bond and Prof. Lovering had charge of the observations in Cambridge. These observations were to be made simultaneously all over the earth, and with instruments constructed according to the Gauss pattern. Cambridge was supplied with a set of these instruments by the generosity of the American Academy of Arts and Sciences.

As, on one day of each month, observations were to be made every five minutes on three different instruments, day and night, for the purpose of obtaining the curves of diurnal variation in the magnetic elements, the assistance of a few competent and zealous undergraduates was freely offered and gladly accepted. Of these, Thomas Hill, afterward President of Harvard College, and Benjamin A. Gould, now the distinguished astronomer, deserve special mention. Prof. Benjamin Peirce rendered valuable service, not only by assisting in the observations on the special days of each month, but in applying the Gauss theory to the calculation of the magnetic elements for Cambridge. Mr. Hill was employed in reducing the weekly means to empirical formulæ by the method of Prof. Peirce.

Profs. Peirce and Lovering were co-editors of the "Mathematical Miscellany," published at Cambridge, and devoted to pure and applied mathematics. The essays contributed by Prof. Lovering are enumerated in the annexed catalogue of his publications. A gentleman who has achieved a world-wide reputation in

science has recently written of Prof. Lovering's articles that they impressed him as few others had ever done. "It will surprise him to know it; yet it is true that the ideas then presented, and with an elegance worthy of their breadth and power, affected the whole tenor and tendency of my thoughts, and thus of my subsequent life. At this moment I could repeat by memory long passages from these articles. They were upon 'The Internal Equilibrium of Bodies,' 'The Application of Mathematical Analysis to Physical Research,' 'The Divisibility of Matter,' etc." And he compares the style of parts of them with that of the most classic passages in Babbage's "Ninth Bridgewater Treatise."

Mr. R. W. Emerson published the following notice for the "Dial":* "We rejoice in the appearance of the first number of this quarterly journal edited by Prof. Peirce. Into its mathematics we have not ventured; but the chapters on astronomy and physics we read with great advantage and refreshment. Especially we thank Prof. Lovering for the beautiful essay on the 'Internal Equilibrium and Motion of Bodies,' which is the most agreeable contribution to scientific literature which has fallen under our eye since Sir Charles Bell's book on the hand, and brings to mind the clear, transparent writings of Davy and Playfair. Surely this was not written to be read in a corner, and we anticipate the best success for this new journal."

Prof. Lovering is a member of the American Academy of Arts and Sciences in Boston; was its corresponding secretary for many years; was afterward its vice-president, and its president since 1880. He is also a member of the National Academy of Sciences, of the American Historical Society of Philadelphia, of the California Academy of Sciences, and of the Buffalo Historical Society. In connection with the work of the United States Coast Survey from 1867 to 1876, he had charge of the computations for determining differences of longitude in the United States and across the Atlantic Ocean, by means of the land and cable lines of telegraph. He was for some years one of the trustees of the Tyndall fund for the endowment of scientific research, and is now one of the trustees of the Peabody Museum of Archæology and Ethnology. Besides the papers already mentioned, Prof. Lovering contributed other articles to the "Memoirs" and "Proceedings" of the American Academy, and scientific articles and reviews to the "Proceedings of the American Association," the "American Journal of Science," the "Journal of the Franklin Institute," the "American Almanac," the "North American Review," the "Christian Examiner," "Old and New," and "The Popular Science Monthly." The following is a list of these contributions:

* Vol. iii, p. 131.

1. "An Account of the Magnetic Observations made at the Magnetic Observatory of Harvard College." In two parts ("Memoirs of the American Academy," vol. ii, 1846.)
2. "On the Secular Periodicity of the Aurora Borealis" (ibid., vol. ix).
3. "On the Determination of Transatlantic Longitudes by Means of the Telegraphic Cables" (ibid., 1867).
4. "Catalogue of Auroras observed, mostly at Cambridge, after 1838" (ibid., vol. x, 1868).
5. "On the Periodicity of the Aurora Borealis." In two parts (ibid., with plates, 1868).
6. "On the Causes of the Difference in the Strength of Ordinary Magnets and Electro-Magnets, of the same Size and Shape." ("Proceedings of the American Academy," vol. ii).
7. "On the Law of Continuity" (ibid.).
8. "On the Aneroid Barometer" (ibid.).
9. "Electrical Experiment" (ibid., vol. iv).
10. "On the Connection of Electricity with Tornadoes" (ibid., vol. ii).
11. "On Coronæ and Halos" (ibid.).
12. "On the Spectroscope" (ibid., vol. iii).
13. "On the Bioscope" (ibid.).
14. "Apparatus for Rapid Rotations" (ibid.).
15. "Shape of Luminous Spots in Solar Eclipses" (ibid.).
16. "Notice of the Death of John Farrar" (ibid.).
17. "Notice of the Death of Melloni" (ibid.).
18. "New Apparatus and Experiments in Optics and Acoustics" (ibid.).
19. "Arago's Opinion of Table-Moving" (ibid.).
20. "On Fessel's Gyroscope" (ibid.).
21. "Apparatus to regulate the Electric Light" (ibid.).
22. "Does the Mississippi River flow Up-hill?" (ibid.).
23. "Report on Hedgcock's Quadrant" (ibid.).
24. "On the Boomerang" (ibid., vol. iv).
25. "Report on Meteorological Observations" (ibid.).
26. "On the Ocean Cable" (ibid.).
27. "On the Polarization of the Light of Comets" (ibid.).
28. "Report on the Polar Expedition of Dr. I. I. Hayes" (ibid.).
29. "On Records of the Aurora Borealis" (ibid.).
30. "First Observations on the Aurora in New England" (ibid.).
31. "Notice of the Death of Biot" (ibid., vol. ii).
32. "On the Velocity of Light and the Sun's Distance" (ibid.).
33. "Notice of the Death of O. M. Mitchell" (ibid.).
34. "On the Optical Method of studying Sound" (ibid., vol. vii).
35. "On the Periodicity of the Aurora Borealis" (ibid., vol. viii, 1873).
36. "On the French Republican Calendar" (ibid.).
37. "Application of Electricity to the Motion of Tuning-Forks" (ibid.).
38. "On Optical Meteorology" (ibid.).
39. "On Transatlantic Longitudes" (ibid.).
40. "Notice of the Death of William Mitchell" (ibid.).
41. "Notice of the Death of Faraday" (ibid).
42. "Notice of the Death of David Brewster" (ibid.).
43. "Notice of the Death of J. W. F. Herschel" (ibid.).
44. "Notice of the Death of Christopher Hansteen" (ibid., vol. ix).

45. "Notice of the Death of Auguste A. de la Rive" (ibid.).

46. "Notice of the Death of James Walker" (ibid., vol. x).

47. "Notice of the Death of Joseph Winlock" (ibid., vol. xi).

48. "Notice of the Death of Alexis Caswell" (ibid., vol. xiii).

49. "Notice of the Death of John H. Temple" (ibid., vol. xiii).

50. "Notice of the Death of Joseph Henry" (ibid., vol. xiv).

51. "Notice of the Death of H. W. Dove" (ibid., vol. xv).

52. "Address as President on presenting the Rumford Medal to J. Willard Gibbs" (ibid., vol. xvi).

53. "Anticipations of the Lissajous Curves" (ibid.).

54. "Notices of the Deaths of Richard H. Dana, of Edward Desor, and of John W. Draper" (ibid., vol. xvii).

55. "Notice of the Death of Sir Edward Sabine" (ibid., vol. xix).

56. "Address of the President on Presenting the Rumford Medal to H. A. Rowland" (ibid.).

57. "Address as President on presenting the Rumford Medal to S. P. Langley" (ibid., vol. xxii).

58. "Notice of the Death of Gustav Robert Kirchhoff" (ibid., vol. xxiii).

58*. "Address as President on presenting the Rumford Medal to A. A. Michelson" (ibid., vol. xxiv).

58**. "The 'Mécanique Céleste' of Laplace, and its Translation by Bowditch" (ibid., vol. xxiv).

59. "On the Electro-dynamic Forces" ("Proceedings of the American Association for the Advancement of Science" (vol. ii).

60. "On a Curious Phenomenon relating to Vision" (ibid.).

61. "On a Singular Case of Interference in the Eye itself" (ibid., vol. vii).

62. "On a Modification of Soleil's Polarizing Apparatus" (ibid.).

63. "On the Australian Weapon called the Boomerang" (ibid., vol. xii).

64. "On the Optical Method of studying Sound" (ibid., vol. xvi).

65. "On the Periodicity of the Aurora Borealis" (ibid., vol. xvi, 1868).

66. "Sympathetic Vibrations between Tuning-Forks and Stretched Cords" (ibid., vol. xvi).

67. "On Methods of Illustrating Optical Meteorology" (ibid., vol. xix, 1871).

68. "On Sympathetic Vibrations" (ibid., vol. xxi, and "Journal of the Franklin Institute," May, 1873).

69. "Addresses as President at the Portland Meeting" (Proceedings of the A. A. A. S., vol. xxiii).

70. "On a New Way of illustrating the Vibrations of Air in Organ-Pipes" (ibid., vol. xxiii).

71. "Address as Retiring President, A. A. A. S." (ibid., vol. xxiii, republished in "The Popular Science Monthly," "American Journal of Science," and the "London Philosophical Magazine").

72. "On a New Method of measuring the Velocity of Electricity" ("Proceedings of the American Association for the Advancement of Science," vol. xxiv, also "Journal de Physique," tome vi).

73. "Shooting Stars" ("American Journal of Science," vol. xxxv).

74. "The American Prime Meridian" (ibid., N. S., vol. ix, 1850).

75. "The Aneroid Barometer" (ibid., N. S., vol. ix, 1850.)

76. "On the Velocity of Light and the Sun's Distance" (ibid., N. S., vol. xxxvi).

77. "Melloni's Researches on Radiant Heat" ("American Almanac," 1850).

78. "Animal Electricity" (ibid., 1851).
79. "Recent Discoveries in Astronomy" (ibid., 1852).
80. "Comets" (ibid., 1853).
81. "Atmospherical Electricity" (ibid., 1854 and 1855).
82. "Lightning and Lightning-Rods" (ibid., 1856).
83. "Terrestrial Magnetism" (ibid., 1857).
84. "Theories of Terrestrial Magnetism" (ibid., 1858).
85. "On the Boomerang" (ibid., 1859).
86. "On the Aurora Borealis and Australis" (ibid., 1860).
87. "On Meteorology" (ibid., 1861).
88. "On the Pressure of the Atmosphere and the Barometer" (ibid., 1862).

REVIEWS, ETC.

89. "Guyot's Physical Geography" ("Christian Examiner," vol. xlvii).
90. "Humboldt's Cosmos" (ibid., vol. xlviii).
91. "Skepticism in Science" (ibid., vol. li).
92. "Spiritual Mechanics" (ibid., vol. lv).
93. "Thompson and Kaemtz on Meteorology" ("North American Review," vol. lxxi).
94. "Elementary Works on Physical Science" (ibid., vol. lxxii).
95. "Michael Faraday" ("Old and New," vol. i).
96. "Reports on Lighthouses." By Benjamin Peirce and Joseph Lovering ("Journal of the Franklin Institute," vol. xviii).
97. "On the Internal Equilibrium and Motion of Bodies" ("Cambridge Mathematical Miscellany," vol. i).
98. "On the Application of Mathematical Analysis to Researches in the Physical Sciences" (ibid.).
99. "Encke's Comet" (ibid.),
100. "The Divisibility of Matter" (ibid.).
101. "Boston and Science" ("Memorial History of Boston," vol. iv).
102. "Article on the Telegraph" ("American Cyclopædia," last edition).
103. "Address at the Dedication of the Mural Monument to the Memory of Dr. James Walker," in the Harvard Church, Charlestown.

SUBJECTS OF LECTURES AT THE LOWELL INSTITUTE.

1840–'41. "Electricity and Magnetism."
1841–'42. "Mechanics."
1842–'43. "Astronomy."
1843–'44. "Optics."
1845–'46. "Astronomy."
1853–'54. "Electricity and Magnetism."
1859–'60. "Astronomy."
1865–'66. "Light and Sound."
1879–'80. "Connection of the Physical Sciences."

Prof. Lovering also edited six volumes, from V to X inclusive, and part of Volume XI, of the "Memoirs" of the American Academy of Arts and Sciences; also the "Proceedings" of the same Academy, Volumes VII, VIII, and XVII.

EDITOR'S TABLE.

MR. WALLACE ON "DARWINISM."

THE recently published work of Mr. Alfred Russel Wallace on "Darwinism" furnishes a timely and weighty answer to those who, following the rash lead of the Duke of Argyll, have lately been maintaining that the doctrine of natural selection is wholly unable to explain the development of species, and that, as a theory, it has had its day. Far from conceding anything to this noisy school, Mr. Wallace is disposed to make even larger claims for the potency of this principle than Darwin himself did, and certainly larger than Mr. Spencer is to-day disposed to allow. He holds that we only have to look closely enough at the facts in order to see the influence of natural selection everywhere, and to convince ourselves that it alone has presided over the whole development of vegetable and animal forms. It is needless to say that Mr. Wallace is a naturalist of the very first rank, and that his reasonings do not lack for facts and illustrations to enforce them. The work he has now given to the world is an exceedingly valuable repertory of information bearing on the questions he discusses, and is written in a style at once popular and exact. In giving it the title "Darwinism," he once more evidences the generosity of nature which led him thirty years ago to waive the claims he might have urged as discoverer of the principle of the variation of species by means of natural selection. He recognizes that Darwin has made that whole field of investigation peculiarly his own; and he is, therefore, very willing that Darwin's name should stand indissolubly and exclusively connected with the great revolution in speculative biology which our generation has witnessed.

The two principal questions which Mr. Wallace's work will bring into prominence are (1) whether the extremely wide claims he puts forth on behalf of natural selection are fully made good; and (2) whether his views in regard to the mode of development of man's higher intellectual and moral nature are well founded. Upon the first point, as we have already hinted, Mr. Wallace comes into direct collision with Mr. Spencer. The latter considers that the doctrine of natural selection can not account for certain cases of variation, and that we must have recourse to the supplementary doctrine of use and disuse. Mr. Wallace takes up the instances cited by Mr. Spencer, and endeavors to show that they may be explained without calling in any other law than that of natural selection. He admits that, as regards those "lower organisms which consist of simple cells and formless masses of protoplasm," the action of the environment is very marked, and that the variations it produces on individual forms may be transmitted by inheritance; but he does not consider that we can argue from cases in which the environment acts thus powerfully on the whole life of the organism, and, of course, necessarily on its reproductive system, so far as it can be said to have a system, to cases where the outward structure alone of well-established types is affected by change of habit. Such modifications he does not think are transmissible by inheritance; spontaneous variation and natural selection alone are adequate, in his opinion, to produce permanent variation. The question is manifestly an obscure one, calling for patient and exhaustive investigation. If changes produced by the environment in the very lowest forms may be transmitted by inheritance, as Wallace admits, then the

question is, at what point the line is to be drawn. How far down may we come in the development of type before this principle ceases to act? Again, how can it be positively ascertained that changes of nutrition, or changes in the general balance of function, may not act on the reproductive system so as to produce inheritable variation? Mr. Wallace does well to stand up for the doctrine of natural selection, and to insist that it shall not needlessly be put aside; but the general doctrine of evolution would not suffer if the exceptions to the action of natural selection contended for by Mr. Spencer should ultimately be maintained.

Refusing to admit any other general law than that of natural selection as a key to the development of species, and finding, as he asserts, that law inadequate to explain man's moral and intellectual nature, or rather the extreme differences existing between individuals in respect to moral and intellectual qualities, Mr. Wallace summons to his assistance the theory of a special "spiritual essence of nature, capable of progressive development under favorable conditions." To explain an unknown thing by one still more unknown has never been considered a quite satisfactory logical performance; and we can not help feeling a little surprised that, in a purely scientific treatise, our author should resort to such a method. "On the hypothesis," he says, "of this spiritual nature superadded to the animal nature of man we are able to understand much that is otherwise mysterious or unintelligible in regard to him." The trouble is that "this spiritual nature," as it does not lend itself to definition, is not and can not be an object of knowledge, and therefore can not serve as a scientific hypothesis at all. It may, however, be questioned whether Mr. Wallace is not untrue to his own principles when he says that the differences in moral and intellectual attributes between different individuals are greater than can exist under the rule of natural selection. Who is to set the limits of spontaneous variation in any species, and, above all, in the most complex and highly organized species, man? In the lower tribes individuals departing in a marked manner from the average type are generally doomed to destruction; but in human society it is different. Human society is itself an organism of ever-increasing complexity as we pass from the lower to the higher races; and in the social organism there is room for an infinite variety of tastes, accomplishments, aptitudes, and powers. A man need not be a great mathematical genius or have a surpassing talent for music in order to survive; neither does an extraordinary development in either direction necessarily lead to his extinction. A place can generally be found for every man whose nature is not absolutely anti-social. Thus extreme variations are preserved, and the qualities they imply are kept, as it were, in circulation in the social body, ready to manifest themselves under suitable conditions. The range of variation in men would probably be greater than it is were it not for the fact that the law of natural selection is at work more or less at all times in suppressing both superiorities and inferiorities. It was an old pastime of a certain venerable race to stone their prophets; and one of their wisest men has left on record the caution: "Be not righteous overmuch, neither make thyself overwise: why shouldst thou destroy thyself?" Nor has the danger of excessive righteousness altogether vanished in our own time, as Mr. Spencer in his essay on "The Morals of Trade" bears impressive witness. But, on the other hand, there are dangers in excessive inferiority. After uttering his caution against over-righteousness the Hebrew moralist goes on to say: "Be not overmuch wicked, neither be thou foolish: why shouldst thou die before thy time?" And to-day, as then, the man who is

overmuch wicked or foolish generally meets an early fate. The law of natural selection is, therefore, manifestly at work in controlling the moral and intellectual development of society; and if, in spite of this, there is a much wider variation between human individuals than obtains in the lower orders of animal life, that is just what, considering the extreme complexity of the social organism, we should have expected.

THE COACH OF CIVILIZATION.

THE author of that popular book "Looking Backward" has given a graphic description of present-day civilization, as he understands it, by comparing it to a coach in or on which the wealthy classes ride while the working classes drag it over heavy roads and up steep ascents. It would almost seem as if the author had been more concerned to write what the French call *une belle page* than to represent things as they really are, otherwise the picture would have been somewhat differently drawn. Nothing is told us of the means whereby seats on the coach are obtained nor of the means by which they are lost. There is no hint that frugality, prudence, self-control, readiness of resource, and social usefulness, are in general the qualities by which men rise to competence, or that it is the lack of these qualities, and often of any disposition to possess them, that consigns some men to the labor of the rope. We do not read that the man who is on the coach has often helped to make better conditions of life for multitudes of his fellow-men, nor is a hint dropped that many of those who get the credit of riding are really themselves laboring hard to help the vehicle forward. There is nothing in the whole description that answers to the case of those intelligent, efficient, and self-respecting workers who, without reaping wealth, obtain a large measure of comfort and ample means of self-improvement. We get no hint of social vices that do more to make the lot of their victims difficult, if not hopeless, than anything in the constitution of society. Mr. Bellamy might, had he chosen, have introduced these points. They are so obvious that he could not have overlooked them, and we must therefore conclude that he omitted them on literary grounds. The way to be tiresome, said Voltaire, is to say everything; and Mr. Bellamy did not want to be tiresome, so he simply gave us a picture of a coach crowded with idlers and dragged by the industrious under the lash of hunger. Well, Mr. Bellamy has produced the effects he aimed at. His coach has been very widely talked about and considerably admired; so perhaps now he might take into consideration those who are not so impatient of details as to prefer a misleading comparison, dashed off with a few bold strokes, to a more correct one carefully elaborated. We know he could make another coach for us if he tried, and we should very much like him to try.

Far be it from us to say that society as we see it to-day has reached the acme of perfection; there is much in it we are deeply persuaded that is faulty and that might be improved. We want greater economy in production and—no one need hesitate to say—greater equality in distribution. We want a greater sense of social responsibility on the part of the holders of wealth, and we want especially a diminution of the senseless passion for display. These things we believe are now on the way, though it might be hard to discern the signs of the one last mentioned. Society is becoming every day more closely knit in the bonds of a common sympathy; the self-respect of the average man is daily increasing and public opinion is becoming at once more rational and more humane. What we have chiefly to contend with to-day is not the idleness or extravagance of a few, but a general lack of knowledge as to the best methods of social co-operation. Where Mr. Bellamy

errs, in our opinion, is in making the wealthy portion of society a simple burden upon the poor. Such is not the case. On the contrary, it is the men of wealth who have done more than any other class to direct labor into useful channels and generally to vivify and fertilize the industry of the world. If Mr. Bellamy could amend his story of the coach so as to bring this undoubted fact into prominence, he would do more justice to the century in which he lives, and take a little of the sting from the diatribes of his Dr. Barton.

LITERARY NOTICES.

EDUCATION IN THE UNITED STATES: ITS HISTORY FROM THE EARLIEST SETTLEMENTS. By RICHARD G. BOONE. New York: D. Appleton & Co. Pp. 402. Price, $1.50.

THIS is the eleventh volume of the "International Education Series," and is characterized by the general editor of that series as the first noteworthy attempt to present the subject, and as forming "a tolerably complete inventory of what exists, as well as an account of its origin and development." We find it a systematic and comprehensive treatise, presenting the important facts in their bearing upon one another and their relations to contemporary conditions. The history is divided into the Colonial and the Revolutionary periods and the period of Reorganization, to which is added a review of "Current Educational Interests." The discussion of "The Colonial Period" comprises the history of the earliest American schools, of colonial colleges, and of colonial school systems. Under "The Revolutionary Period" are sketched the conditions of elementary, secondary, and collegiate education during the time included. The third part, "The Period of Reorganization," includes accounts of the transition from the old to the new, with its centralizing tendencies, the agencies and methods for the preparation of teachers, the development of the course of instruction in the more recent colleges, the aspects of professional, technological, and special education, the growth of supplemental institutions, learned societies and libraries, and the relations of Government and education. "Current Educational Interests" embrace "Compulsory School Attendance," "The Gradation of Schools," "Education in the South," and "The Higher Education of Women." To each chapter is appended a bibliography. The author's aim has been "to suggest lines of thought for the teacher and sources of information, and, avoiding mere description on the one side and personal criticism on the other, to exhibit faithfully the development of contemporary institutions and educational forces, with something of their national setting." The editor, Dr. Harris, sees in the trend of the educational movement, as disclosed in this history, a tendency from private, endowed, and parochial schools, toward the assumption of education by the state, away from isolated efforts and toward system and supervision, and in methods toward the adaptation of the matter of instruction to the mind of the child and toward improved discipline. The entire educational idea of the people, too, "has progressed in the direction of divine charity," as is exemplified in the greater attention paid to the education of women and to institutions for unfortunates. The author finds our educational system still very imperfect, and notices as problems yet unsolved or not provided for the means of securing a supply of qualified teachers; a way, while shaping the understanding mind, of bringing up youth with sound bodies and a love for truth; the relation which the public schools should sustain to industrial training; questions concerning infant and primary and free public higher and professional education; extra-school training; and the constitution of a citizenship education. A hopeful outlook is discerned in the fact that common-school questions are being studied by college presidents and professors as related to their own labors, and by economists and historians.

INDOOR STUDIES. By JOHN BURROUGHS. Boston and New York: Houghton, Mifflin & Co. Pp. 256. Price, $1.25.

MR. BURROUGHS is best known as a writer about Nature, or outdoor subjects. In that department he has gained a position among the select representative authors of our country. Completely at home amid rural sur-

roundings, communing with Nature, and then drawing from the hidden stores of his mind what he has absorbed from her, independent in thought and thoroughly American, and pithy and vigorous in expression, he found an audience as soon as he took the platform from which he was best fitted to speak; and that audience has been growing ever since. In the "Egotistical Chapter," which forms one of the "studies," he relates how, like many other authors who have afterward achieved success, he groped in unlucky experiments before he found his proper place. He began by reading books of essays and trying to catch their style; and wrote essayish papers on subjects whose interest was so universal that it was spread out very thin, to have them sent back by the journals to which he offered them; and finally took to outdoor themes "to break the spell of Emerson's influence, and get upon ground of his own." His style, which is of the most forcible, and in which strong thoughts are condensed into few words of most direct meaning, is the result of much study and discipline, in which, he says, "I have taught myself always to get down to the quick of my mind at once, and not fumble about amid the husks at the surface." Of late years he has been giving more attention to literary topics and subjects of scientific discussion, although in these also the nature-side appears most prominent to his view. The present volume is largely made up of articles of this character. In them he displays the same independence that characterized his earlier work—a determination to say what he thinks, without giving himself worry concerning what others may have said or thought. In two of the longer essays—"Matthew Arnold's Criticism" and "Arnold's View of Emerson and Carlyle"—the literary side is alone conspicuous; in two others, "Henry D. Thoreau" and "Gilbert White's Book," we have the student of nature appreciating and criticising his two most illustrious co-workers in the same line. "Science and Literature" is an attempt to measure the value of science in culture, in which the author indicates that "the final value of physical science is its capability to foster in us noble ideals, and to lead us to new and larger views of moral and spiritual truths. The extent to which it is able to do this measures its value to the spirit—measures its value to the educator. That the great sciences can do this, that they are capable of becoming instruments of pure culture, instruments to refine and spiritualize the whole moral nature, is no doubt true; but that they can ever usurp the place of the humanities or general literature in this respect is one of those mistaken notions which seem to be gaining ground so fast in our time." In "Science and the Poets" Emerson is held up as the poet whose work has been most influenced by science. "A Malformed Giant" is a brave criticism of Victor Hugo's excesses of style and manner. Of the eight "Brief Essays," "The Biologist's Tree of Life" touches a scientific subject, and "An Open Door" relates to the question of a superintending Providence.

RIVERSIDE LIBRARY FOR YOUNG PEOPLE. No. 3. BIRDS THROUGH AN OPERA-GLASS. By FLORENCE A. MERRIAM. Pp. 223. UP AND DOWN THE BROOKS. By MARY E. BAMFORD. Pp. 222. Boston: Houghton, Mifflin & Co. Price, 75 cents each.

THE "Riverside Library" series is designed especially for boys and girls who are laying the foundation of private libraries, and is intended to consist not of ephemeral publications, but of "books that will last." It will comprise principally books of history, biography, mechanics, travel, natural history, adventure, and kindred themes, with fiction not excluded, presenting the various subjects in an attractive manner, but not in the "*Childese* dialect." The author of "Birds through an Opera-Glass," recognizing the perplexities of young observers, has tried to supply their wants, the chief of which in studying birds is the means of distinguishing and identifying them without having to become ornithologists or to grapple with the technical terms in the text-books. The opera-glass supplies a means of looking at the creatures as if from a shorter distance than it is possible to approach them, and will or should supply the points by which they are to be recognized. To these points are added such facts as lie within reach of the young observer's opportunities respecting the song, nesting, and general behavior of the bird. The robin supplies the standard by which all the other birds are com-

pared. Some simple and easily followed rules for observation are given. With these, the opera-glass, and his own good sense, the young observer is introduced by the aid of the pleasing descriptions to some seventy species. To these are added a table, which the author calls "pigeon-holes," for the classification of the birds, synopses of general family characteristics and of arbitrary classifications, and a list of books for reference.

"Up and Down the Brooks" is the story told in a similar spirit of the insect life in and upon the water. The specimens serving as types were collected in the brooks of one of the counties of California; but the author judges rightly that members of the same families may be found by almost any brook East or West, and that her accounts will serve for all. These insects are such as every one sees dancing upon the water, swimming in it, or flying above it; but few have any real acquaintance with their nature, mode of growth, habits of life, or affiliations. To those who wish to know about them, this little series of sketches will be convenient and instructive as well as entertaining.

DAYS OUT OF DOORS. By CHARLES C. ABBOTT. New York: D. Appleton & Co. Pp. 323. Price, $1.50.

A BOOK about Nature by Dr. Abbott by this time needs no special introduction to the readers of the "Monthly." They have all had a taste of the author's quality as an observer and describer of outdoor life, and know that he is capable of transmitting to any others who will listen to him or read him the variety and enjoyment that he finds there. As the

> "ragged cliff
> Has thousand faces in a thousand hours,"

Dr. Abbott finds the same to be "true of the tamest pasture, where not even the clover and buttercups of one side are the twins of the buttercups and clover of the other"; and where through the succeeding changes of the year objects of interest "never repeat themselves, or else I am daily a new creature. Nor sight nor sound but has the freshness of novelty, and one rambler, at least, in his maturer years is still a boy at heart." These changes by the month and season enter into the plan of the present book, which presents a kind of naturalist's calendar or diary of the months. The birds figure as the principal characters, though other objects of life are not unregarded, and the story of their coming and going, or sometimes staying, their working, sporting, cooing, nest-breeding, and initiation into the experiences of life, is recorded consecutively from January through the winter, spring, summer, and autumn months, till December closes the cycle and ends at the time when a new series is to begin. Other people find novelties and things of ever refreshing interest abroad. Dr. Abbott does not deny them the pleasure, for he can do and has done the same; but he can find, too, all that is needed to make life worth living on the banks of his unpretending creek and modest river to which it is ever his pleasure to return. Therefore he holds "that one need not mope because he has to stay at home. Trees grow here as suggestively as in California, and the water of our river is very wet. Remember, too, if trees are not tall enough to suit your whim, to lie down beneath the branches of every one of them, and, as you look up, the topmost twig pierces the sky. There is not an oak but will become a gigantic *Sequoia* in this way. One need learn no magic to bring the antipodes home to him." This is, perhaps, the principal lesson taught in the book, and it is made extremely palatable by the spice of familiar illustration, incident, adventure, personal delineations, old lore of history and tradition, and pictures of the brook and fields and their incessantly changing life.

PHYSICAL REALISM. By THOMAS CASE, M. A. London and New York: Longmans, Green & Co. One vol. 8vo. Pp. 387. Price, $5.

THIS is an able and scholarly work, well worthy the attention of those familiar with the course of philosophical thought and fond of philosophical discussion. The argument of the author is that we sensibly perceive an internal but physical world—physical objects of sense in the internal nervous system—from which we infer an external and physical world. This is "physical realism." It is opposed to intuitive or natural realism, which declares that we directly perceive an external physical world; and to cosmothetic idealism, which concludes that we are sen-

sible of a psychical, but infer a physical world. It also controverts all the strictly idealistic hypotheses. The treatise is divided into two parts, the first containing the "General Proof of Physical Realism," and the second dealing with "Psychological Idealism." This last embraces in successive chapters criticisms of the philosophies of Descartes, Locke, Berkeley, Hume, and Kant, from the author's point of view. These discussions are very acute and interesting. In general, it may be said that the negative part of the work, or the refutation of idealistic doctrines, is more successful and more valuable than the constructive portion which involves the substantiation of the author's theory.

PSYCHOLOGY AS A NATURAL SCIENCE, APPLIED TO THE SOLUTION OF OCCULT PSYCHIC PHENOMENA. By G. C. RAUE, M. D. Philadelphia: Porter & Coates. 8vo. Pp. 541, 1 vol.

THIS is a disappointing book. Its psychology is crude, and as "applied to the solution of occult psychic phenomena," it does not appear to solve anything. The occult phenomena, indeed, are not reached till page 380, and the part relating to them is largely taken up with extracts from well-known authors (like those belonging to the Society for Psychical Research, Mesmer, Braid, Fahnestock, and others), upon which Dr. Raue makes, it must be said, some interesting comments; but he adds nothing, so far as we are able to make out, to the store of human knowledge upon the subject. What explanation he does give is an application of his psychology, which is based upon or rather an exposition of that of Dr. Friedrich Eduard Beneke, who, the author thinks, has been undeservedly neglected by succeeding thinkers. In this notion we can not agree with Dr. Raue, because there is nothing sufficiently significant in Beneke's work to make it worth while for students of the present time to recur to his writings. A sample of this applied psychology is found in the explanation of "thought-transference." The latter may be understood, according to the author, if we suppose that the soul actually consists of different systems of substantial primitive forces, having "mobile elements," and producing different mental modifications which are *spaceless*, "and consequently not restricted by any corporeal distance or interference, so that they can reach a similar psychic modification in another mind as well as in their own, and impart to it their own state of excitement and make it conscious." But how, pray, are we able to conceive of motion without space or "room" for motion? And if thought is thus excited in one person by the attraction of similar excitation in another, there being motion from the one to the other, what more is this than a statement that there is some subtle power of thought-transfer which we do not understand? To make such an averment we hardly need Dr. Raue's book.

Thus, while the scholar will always find much to interest him, and much to approve in any work of this character, prepared with serious purpose, we can not recommend it to those who are only able to give a limited amount of attention to the topics of which it treats, being persuaded that they can more profitably spend their time upon something else.

It is a little singular that no mention is made in this book (written by a Philadelphian) of the very interesting and valuable report by the Seybert Commission of the University of Pennsylvania upon some of the most curious of these "occult psychic phenomena."

THE PHILOSOPHY OF KANT; AS CONTAINED IN EXTRACTS FROM HIS OWN WRITINGS. Selected and translated by JOHN WATSON, LL. D., Professor in Queen's College, Kingston, Canada. One vol. Pp. 356. Macmillan & Co. Price, $1.75.

KANT'S KRITIK OF THE PURE REASON EXPLAINED AND DEFENDED. Being Vol. I of Kant's "Critical Philosophy for English Readers." By JOHN P. MAHAFFY, D. D., and JOHN H. BERNARD, B. D. Pp. 389. Macmillan & Co. Price, $1.75.

THE demand for a return to Kant, which has been evident in the philosophical world for a few years past, has issued in a good deal of new and valuable Kantian literature, and there is likely to be more; for it can not be denied that this return to the study of Kant has produced an increase of his authoritative influence. Whatever our views may be of the wisdom of pursuing philosophy under the chief guidance of the Königsberg sage, and whatever may be our opinion of the value of his principles and method, there is no doubt that a thorough study of his

works is indispensable, not only for scholarship's sake but also to secure a proper mental equilibrium in forming a theory of knowledge, on the part of those especially who have been educated to rely on *a posteriori* methods. For the reason just given the scientific student can least of all afford to neglect Kant, and if he has a contempt for this philosopher he may be assured that there is still opportunity for creditable achievement in the way of refuting the author of the "Kritik" on many important points still left for the ambitious controversialist.

The two works above mentioned are excellent, each in its own way, for the purpose of making the student acquainted with Kantian philosophy. Prof. Watson's idea is to present to a class of more advanced students a series of carefully selected extracts from the chief treatises of Kant, "The Critique of Pure Reason," "The Metaphysic of Morality," "The Critique of Practical Reason," and "The Critique of Judgment"; then to aid these students by the discussions of the class-room, using the extracts as a text-book. It must be borne in mind that, except possibly where a student is devoting himself exclusively to philosophy, never could he hope to go over the whole of the four works just named under the teacher's class instruction. The advantage, then, of a work like Prof. Watson's is very apparent, if the selections have been so judiciously made as to present connectedly the most important parts of the treatises. In accomplishing this the editor has been very successful. He has made good his claim that the volume "contains all the main ideas of Kant in their systematic connection," and he has produced a very useful book for those who have not the time to devote to Kant's works in full, and also an excellent preparatory course for those who intend to go further in studying that philosopher.

Prof. Mahaffy's book is a good one for the student to read in connection with a text-book like Prof. Watson's. It is expository and critical; we regret to say it is also polemical, the latter quality constituting its chief weakness. In a somewhat extravagant preface Prof. Mahaffy expresses his conviction that Kant is "certainly the greatest" of all metaphysicians, "and perhaps the most imperfectly understood." We do not think the writers of this volume have added anything to Kant's greatness, whatever it may be, but we do consider that they have contributed something to a better understanding of him. For the most part they have correctly apprehended their master's meaning, and have clearly interpreted him in a style of diction which is very agreeable and well calculated to hold the student's attention. This volume is to be followed by a second, containing the "Prolegomena" of Kant.

STATE OF NEW YORK. TWENTY-SECOND ANNUAL REPORT OF THE STATE BOARD OF CHARITIES, 1888. CHARLES S. HOYT, Secretary. Pp. 608.

THE visitorial powers of this board extend to all charitable, correctional, and eleemosynary institutions, excepting State prisons, supported wholly or in part by the State, or by cities, counties, incorporated benevolent associations, or otherwise. Its executive duties are the supervision of the support, care, and removal of State paupers; the examination and removal of alien paupers to their homes in different countries of Europe; watch of the care of the insane; the approval and certification of incorporations for the custody and care of dependent children; and the oversight and control of insane Indians on the several reservations of the State. It has also authority to require reports from the various institutions subject to its visitation. The institutions included within this jurisdiction have in all $54,310,658 of property; return as the year's receipts, $14,591,817, and $13,315,698 expended; and care for 64,322 persons. The report gives a picture of their general condition and operations.

"WAR WITH CRIME." Being a Selection of Reprinted Papers on Crime, Reformatories, etc. By the late T. BARWICK LL. BARKER, Esq. Edited by HERBERT PHILIPS and EDMUND VERNEY. London and New York: Longmans, Green & Co. Pp. 299. Price, $4.

MR. BARKER, who died in December, 1886, is described as having been a man of diligent thought, who sought out the principles that underlie the practical side of every question. "A country squire of moderate wealth, he studied the duties incumbent on him in that

station of life; a country magistrate, he felt bound to inquire into the causes of crime, and to use for the benefit of the community the experience gained on the bench; a poor-law guardian, he was drawn into personal sympathy with the poor, the outcast, and the destitute." The papers he left behind him, from which the selection of those in the present volume was made, embody his well-digested thought on a variety of subjects, and many of them deal with problems still unsolved. Of those here presented, three deal with the prevention of crime generally; others present as a practical measure for that object the apportionment of sentences to crimes on a scientific principle which should be made clearly understood, of "cumulative punishment." This means gradation according to the antecedents of the offender and the number of repetitions of the offense, with a term of police supervision added, under which the man might be encouraged to try to regain his character in honest employment. Other papers deal with adult reformatories; the imprisonment of children, which is advocated under certain conditions; jail labor; reformatories; measures for just dealing with vagrants; ecclesiastical questions; education; labor and wages; and the prisons bill (Mr. Cross's of 1876).

EXPLORATION OF THE CHEST IN HEALTH AND DISEASE. By STEPHEN SMITH BURT, M. D. New York: D. Appleton & Co. Pp. 206. Price, $1.50.

THIS manual, which embodies the methods pursued by the author with his classes, is intended to aid the student in learning the significance of physical signs and their mode of development. Dr. Burt states that he has made no attempt to establish distinctive signs of disease, because he is convinced that "precision in diagnosis is more surely attained by treating each sign as subordinate to the various combinations of signs which are found in the different maladies." The text is illustrated with cuts showing the position of the heart and lungs with reference to each other and to the chest-walls, the forms of instruments, etc. In describing the different forms of stethoscopes, the author expresses a preference for one which engages both ears. He has discovered, by means of the double stethoscope, what he deems a demonstration of the dual function of the ears, viz., for perceiving the direction of sounds. When listening to the ticking of a watch with a binaural stethoscope having arms of soft rubber tubing, if one arm is closed by pinching it, the watch seems to have been removed to the ear which still hears its ticking. If the tube is released and the other one is closed, the watch appears to be transferred, not to its actual place, but to the other ear.

ANNUAL REPORT OF THE CHIEF SIGNAL-OFFICER OF THE ARMY TO THE SECRETARY OF WAR FOR THE YEAR 1888. By A. W. GREELY. Washington: Government Printing-Office. Pp. 418.

ON the military side of his functions, the Chief Signal-Officer records the steps he has taken to secure a suitable heliograph apparatus, the selection of field-glasses for army use, and experiments with homing pigeons. The inadequacy of the present methods to insure instruction in military signaling is lamented, with the declaration that "there is not an average of two officers to a regiment who are competent to transmit signals —by sun, flag, and torch—day and night, except those who have passed through a regular course of instruction in connection with this office." A valuable report by Lieutenant Thompson on foreign organizations and appliances for signaling forms one of the appendixes of the volume. In the matter of the weather service, credit is accorded to three of the principal newspapers of the country for the assistance given by their meteorological editors in supplementing the general predictions made by the office by their own local predictions, and to other journals for publishing meteorological data of local interest. Of the storm-signals, 77·4 per cent were verified; the system of cold-wave observations was continued successfully and satisfactorily. Observations on atmospheric electricity were continued at four stations. Bulletins showing the effect of the weather on the crops were issued weekly. The railway bulletin service has decreased, having been largely superseded by the State services, which are well spoken of. The question of river observations, in relation to dangerous floods and the stages of navigation, engaged attention. A system of rainfall stations was instituted in July, 1887, at

suitable points in the great water-sheds, near the sources of the principal tributaries of the largest rivers. Improvements in the organization of the service are shown to be much needed to make it as efficient as it should be.

FUNDAMENTAL PROBLEMS. THE METHOD OF PHILOSOPHY AS A SYSTEMATIC ARRANGEMENT OF KNOWLEDGE. By Dr. PAUL CARUS. Chicago: The Open Court Publishing Company. Pp. 267. Price, $1.

THE papers presented in this volume, constituting a constructive series of philosophical essays, first appeared for the most part in the editorial columns of "The Open Court." They were there subjected to criticism and discussion which the author has turned to advantage in revising and rearranging and adding to them. Philosophy is regarded, from a point of view both radical and conservative, as the most practical and important science, whose problems lie at the bottom of all the single sciences, of which religion and ethics are applications. The view is radical, because the issues of philosophic thought are presented in their rigidity without trying to conceal the consequences to which the argument leads, with the old and long-cherished errors faced and critically explained; and conservative, because the historical connection with the work of our ancestors is regarded, and progress is sought through a development from the past, not by a rupture with it. "A philosophy of most radical free thought" is presented, "that is no negativism, no agnosticism, and no metaphysical mysticism, but a systematic arrangement of positive facts." This philosophy is monism, or a conception of all existence as one. This is complemented by meliorism, or the conception of a purified, higher view of life.

HOME GYMNASTICS FOR THE WELL AND THE SICK. Edited by E. ANGERSTEIN, M. D., and by G. ECKLER. Translated from the Eighth German Edition. Boston: Houghton, Mifflin & Co. Pp. 94. Price, $1.50.

WHILE setting forth in no uncertain terms the invigorating effects of systematic bodily exercise, the authors of this manual frankly caution the reader against resorting to gymnastics for the cure of serious diseases, certainly not without previous consultation with a physician, and they warn him also not to impatiently expect striking results after a few weeks' practice. The book comprises some general rules and information about home gymnastics, which is followed by detailed descriptions of sixty-nine exercises, most of which need no apparatus, while for the others dumb-bells, a wand, and a chair are the only articles required. Fifty-two cuts illustrate the descriptions. General directions and specific lists of exercises are then given for the use of boys and girls of different ages, for young men, young women, mature men and women, and for old age. Similar directions and groups of exercises are given adapted to certain conditions of ill-health or imperfect development, such as general weakness, weak chest, stagnation in the abdominal organs, corpulence, bent carriage, etc. A large sheet containing all the cuts, and a list of the exercises, accompanies the volume.

STATE OF NEW YORK. THIRTY-FIFTH ANNUAL REPORT OF THE STATE SUPERINTENDENT OF PUBLIC INSTRUCTION, 1889. ANDREW S. DRAPER. Pp. about 1,000.

THE year covered by this report is described as having been one of marked educational activity. A new interest in educational work was manifested, and showed itself most intelligently in directions which promise the best results. The rivalries and antagonisms between different classes of educational workers are disappearing. The criticisms of the public schools have prompted examination of deficiencies and the search for means of remedying them. More study is given to the history and philosophy of education than ever before; and "on every side a new and healthful interest in public-school work, on the part of those charged with the carrying on of that work, is apparent." The cost per capita of educating the children of the State is put at various amounts, according to the rule by which it is estimated, but the real cost, for the children actually attending the schools, is ultimately fixed at $15.19. The expense per capita of the whole population was $3.08. The statistics of attendance are claimed to show that, while it is relatively smaller than formerly, the school work of the State has grown somewhat in substantial character during the last thirty years. Since 1865 the average attendance in the cities has

advanced about evenly with the advance in total enrollment, and in the towns it has increased twenty per cent, while the total enrollment has fallen off nine per cent. The results of inquiries into the compulsory educational methods of England, France, and Germany are reported. More attention to purely professional work in the examination of teachers is recommended. The superintendent is accustomed, in accordance with the law of the State, to indorse the certificates and diplomas issued by State superintendents and normal schools in other States; and he has had some correspondence with other superintendents with reference to a general understanding on this matter. The responses have not been as general or as satisfactory as was desired. The superintendent believes that the movement in favor of the manual-training system has been retarded by the fact that "the kinds of industrial work which have been pushed forward were such as seemed incongruous with school work and gave small promise of assimilating with it"; and he regards free-hand drawing as offering a simple and practicable means of reaching the same end. Considerable space in the report is occupied with the discussion of questions concerning school libraries. Several valuable documents are included among the "Exhibits" and in the appendix.

THE MODERN SCIENCE ESSAYIST. Monthly. Boston: The New Ideal Publishing Company. Ten cents a number, one dollar a volume of twelve numbers.

THIS periodical has been established as a medium for the publication of essays and lectures presenting the modern scientific or evolutionary aspect of various subjects. Each number contains one essay. The six numbers before us contain the first six of the fifteen lectures on different phases of evolution, delivered before the Brooklyn Ethical Association last winter. These lectures followed a logical order. The first two were biographical sketches of the two great men whose names are most intimately associated with the evolution hypothesis—Herbert Spencer and Charles Robert Darwin, the former by Daniel G. Thompson and the latter by Rev. John W. Chadwick. The third is on "Solar and Planetary Evolution," by Garrett P. Serviss, and is illustrated. This is followed by "Evolution of the Earth," by Lewis G. Janes; "Evolution of Vegetal Life," by William Potts; and "Evolution of Animal Life," by Rossiter W. Raymond. The plan of the series included lectures on the descent of man, evolution of mind, society, theology, and morals; proofs of evolution, its philosophy, and its relations to religious thought and the coming civilization. In undertaking to present to its members and the public in a popular form the leading ideas of the evolution philosophy, this association has entered upon a work in harmony with the most enlightened spirit of the time, which can not fail to produce beneficial and gratifying results. The lectures of last winter were delivered by men having special fitness for dealing with the subjects assigned to them, and each furnishes an excellent introduction to a course of reading on its special topic. We learn that the association is to conduct a similar series of lectures next season, and that its success has led to the formation of similar organizations in various parts of the country.

ANNUAL REPORT OF THE BOARD OF REGENTS OF THE SMITHSONIAN INSTITUTION, for the Year ending June 30, 1886. Part I. Washington: Government Printing-Office. Pp. 878, with Plates.

BESIDES the operations of the Institution itself and of the National Museum and Bureau of Ethnology, which are regularly under its charge, this report includes sketches of the work of the United States Fish Commission and Geological Survey, which, though independent of the Institution, are related to it in line of work. Not so much as usual is recorded in the way of explorations—partly because the work has been completed in many of the districts, and partly because means have been lacking for beginning new enterprises of any magnitude. The list of publications, besides bibliographies and catalogues, includes several works and monographs of importance and general interest. The development of the National Museum, as measured by the acquisition of fifteen hundred lots of specimens, was unexpectedly great. Besides the central reference library of the museum, sectional libraries have been established in the scientific departments. In

the Bureau of Ethnology, the field work includes mound explorations, explorations in ancient and modern stone villages, and general field studies in institutions, linguistics, etc.; the office work has consisted largely in giving literary form to the results of the field work. The operations of the Geological Survey and the Fish Commission are presented in brief summaries. The summaries and "occasional papers" in the appendix include ten papers relating to anthropology; an article on "Certain Parasites, Commensals, and Domiciliaires in the Pearl Oysters," by R. E. C. Stearns; "Time Reckoning in the Twentieth Century," by Sandford Fleming; and a "Report on Astronomical Observations," by George H. Boehmer.

EXAMINATION OF WATER FOR SANITARY AND TECHNICAL PURPOSES. By HENRY LEFFMANN, M. D., Ph. D., and WILLIAM BEAM, A. M. Philadelphia: P. Blakiston, Son & Co. Pp. 106. Price, $1.25.

THE aim of this manual is to present processes which are trustworthy and practicable, without any useless matter. Certain processes which have long held prominent places are not admitted to this volume, for instance, the soap test for hardness, which is rejected on the authority of Hehner, who has declared it inaccurate, and has devised the method here presented. The colorimetric tests for nitrates and nitrites are described to the exclusion of the processes heretofore in use. Besides the descriptions of analytical operations, the text includes a chapter on the interpretation of results, dealing with the action of water on lead, living organisms in water, identification of the source of water, and the purification of drinking and boiler waters. Tables of various analytical data are appended, there are several pictures of apparatus, and a number of sheets of labels accompany the volume.

COLLEGE BOTANY. By EDSON S. BASTIN, Professor of Botany, Materia Medica, and Microscopy in the Chicago College of Pharmacy. Chicago: G. P. Engelhard & Co. Pp. 451. Price, $3.

AS indicated by its title, this work is adapted to students of some maturity. The first subject taken up in it is "Organography," the organs being divided into those of vegetation and those of reproduction. In describing the organs something is told of their functions, although a short division of the volume is devoted to "Vegetable Physiology," after "Vegetable Histology," which is the second subject treated. Appended to the chapters on histology are directions for the use of the microscope and accessory apparatus. Suggestions for laboratory work follow each chapter in these three divisions of the book. The fourth and closing part is occupied with "Vegetable Taxonomy," ending with a brief account of the succession of plants in geologic time. The text is illustrated by nearly six hundred cuts, largely from drawings by the author, and a glossary of botanical terms is appended. The volume is somewhat marred by typographical errors.

In the *Introduction to Sawyer's Bible*, the *Rev. Leicester A. Sawyer*, of Whitesboro, N. Y., in view of a new translation in course of publication by him, sets forth his views respecting the character, authenticity, date, and purpose of the several books of Scripture. He holds that if the prodigies and miracles of both Testaments are explained in the light of modern science, and if the judgment of the ancients is tested by the laws of evidence ruling in the courts, they will be found "to have been attested only by incompetent witnesses, and by supposed proofs that are entirely sophistical"; and claims that his work will show many of the supposed facts to have been fictions, and of the prophecies to have been written and antedated after the event had occurred. He finds many errors which the late revision has failed to correct, but concerning which he expects to contribute to the formation of right views; and hopes also that his scheme may be adapted to facilitate more successful Bible study than has been generally possible hitherto by readers of English Bibles.

Vol. IX of the *Observations of the National Argentine Observatory* covers the work done during the year 1876, which was directed by *Juan M. Thorne*, in the absence of Dr. Benjamin A. Gould. The volume contains 18,021 determinations of the positions of southern stars.

No. V of Vol. XVIII of the *Annals of Harvard College Observatory* records the observations of the total eclipse of the sun, Au-

gust 29, 1886, made by Prof. *W. H. Pickering*, with the aid of volunteer assistants, on the island of Grenada, in the West Indies. The account is accompanied by four plates. No. VII of the same volume is a record of *A Photographic Determination of the Brightness of the Stars*, all of the measures involved in this work, the identification of the stars, and the numerical computations having been made, with few exceptions, by Mrs. *M. Fleming*. The paper contains a catalogue of 1,009 close polar stars, one of 420 stars in the Pleiades, and one of 1,131 equatorial stars. Part I of Vol. XX is a record of *Observations made at the Blue Hill Meteorological Observatory in the Year 1887*, and is introduced by a description of the observatory and its work, by *A. Lawrence Rotch*, S. B., its proprietor and director. Mr. *H. Helm Clayton* is the observer. The Observatory of Harvard College now co-operates with the Blue Hill Observatory by publishing the observations of the latter, and a consolidation of the two institutions is contemplated. The present record comprises tables of hourly values of atmospheric pressure, air temperatures, wind azimuths and movements, precipitation, bright sunshine, cloud observations, etc., etc. There are six plates showing tracings by self-registering instruments, and a view of the observatory. The Third Annual Report of the *Photographic Study of Stellar Spectra*, conducted at the Harvard College Observatory, and constituting the Henry Draper Memorial, sketches briefly the progress of the work during 1888.

The fourth number of the *Proceedings of the American Society for Psychical Research* (Damrell & Upham, $1) is a pamphlet of about three hundred pages, nearly a third of which is devoted to the report of the committee on phantasms and presentiments, by Prof. J. Royce. The report contains accounts of a large number of cases, with corroborative evidence, and an estimate of their value. A record of experiments in thought transference is contributed by Mr. and Mrs. John F. Brown, and a report upon "the diagram tests," by Prof. C. S. Minot. The theory of telepathy is discussed by Mr. Hodgson and Prof. Minot. The report of the committee on mediumistic phenomena is instructive, in spite of its brevity, for it mentions as an obstacle to this work that mediums which have been recommended to the attention of the committee are constantly being shown up as impostors. Still, the committee has made some investigations, which it is not ready to report, and hopes to make more.

PUBLICATIONS RECEIVED.

Abbott, Charles C. Days out of Doors. New York: D. Appleton & Co. Pp. 323. $1.50.

Allen, Alfred H. Commercial Organic Analysis. Vol. III, Part I. Philadelphia: P. Blakiston, Son & Co. Pp. 481. $4.50.

Allen, William F., and Spencer, David E. Higher Education in Wisconsin. Washington: Government Printing-Office. Pp. 68.

Atwater, W. O. The What and Why of Agricultural Experiment Stations. Washington: Government Printing-Office. Pp. 16.

Austin, Peter T., New Brunswick, N. J. Address on Scientific Agriculture. Pp. 16.—Chemical Lecture Notes: Specimen pages.—Hypochlorous Acid in Alkaline Solution. Pp. 4.—Lecture Experiments with Nitrous Acid. Pp. 6.—Lecture Experiments. Pp. 4.—Dark Rooms and Developers. Pp. 8.—The Relation of Fertilizers to Fruits. Pp. 8.—A Vexatious Mixture for Qualitative Analysis. Pp. 3.—English Examinations. Pp. 5.—A Handy Record-Book. P. 1.—Petroleum as an Explosive. P. 1.

Barrows, W. B. The English Sparrow in North America. Washington: Government Printing-Office. Pp. 405, with Map.

Bolelle, B. A. Daudet's "La Belle-Nivernaise," with Introduction and Notes. Boston and New York and Chicago: D. C. Heath & Co. Pp. 101.

Branner, J. C., and Brackett, R. N., Little Rock. The Peridotite of Pike County, Ark. Pp. 10, with Plates.

Bush, George Gary. History of Education in Florida. Washington: Government Printing-Office. Pp. 54.

Butler, A. O. What Moses Saw and Heard. Chicago: R. R. Donnelley & Sons. Pp. 484.

Collar, William C. Practical Latin Composition. Boston: Ginn & Co. Pp. 268.

Commonwealth Publishing Company, Denver, Col. "The Commonwealth," June, 1889. Monthly. Pp. 142. 35 cents; $4 a year.

Day, David T. Mineral Resources of the United States, 1887. Washington: Government Printing-Office. Pp. 892.

Dubois, Prof. A. J. Science and Miracle. Pp. 32.

Ellwanger, George H. The Garden's Story. New York: D. Appleton & Co. Pp. 345. $1.25.

Failyer, G. H., and Millard, J. T. Report of the Chemical Department of the Kansas Agricultural Experiment Station for 1888. Manhattan. Pp. 49.

Garnett, James M. Elene; Judith; Athelstan; Byrhtnoth. Translations of Anglo-Saxon Poems. Boston: Ginn & Co. Pp. 70.

Ginn & Co., Boston. Catalogue and Announcements for 1889. Pp. 152.

Griswold, W. M., Bangor, Maine. Annual Index to Periodicals for 1888. Pp. 47.

Howard, George E. Introduction to the Local Constitutional History of the United States. Baltimore: Publication Agency of Johns Hopkins University. Pp. 526.

Johnston, H. H. The History of a Slave. New York: D. Appleton & Co. Pp. 168. 50 cents.

Jones, Charles Edgeworth. Education in Georgia. Washington: Government Printing-Office. Pp. 154.

McClure, William S. Scientific Materialism; its Effect in Art and Morals. Albany: The Argus Company. Pp. 16.

MacDonald, Rev. D., Savannah Harbor, New Hebrides. Oceania, Linguistic and Anthropological. London: Sampson Low, Marston, Searle & Rivington, Limited. Pp. 218.

Meriwether, Colyer. History of Higher Education in South Carolina.

Michigan. Report of H. B. Baker, Secretary of the State Board of Health, for 1887-'88. Pp. 328.—Agricultural College Experiment Station Bulletins, Nos. 50 and 51.—The Grain-Plant Louse, and Enemies of the Wheat Aphis. Pp. 6 and 7. Lansing.

New York Agricultural Experiment Station. Peter Collier, Director. Bulletin. A Study of the Corn-Plant: Lucern or Alfalfa.

Ohio Agricultural Experiment Station Bulletin, Columbus. Colic of Horses. By H. J. Detmers. Pp. 48.

Ryder, Prof. John A. The Origin and Meaning of Sex. (Two papers.) Pp. 2 and 3.

Sensenig, David M. Numbers Universalized. An Advanced Algebra. Part I. New York: D. Appleton & Co. Pp. 358. $1.40.

Sizer, Nelson. Right Selection in Wedlock. New York: Fowlers & Wells. Pp. 31. 10 cents.

Smith, Charles Lee. History of Education in North Carolina. Washington: Government Printing-Office. Pp. 180.

Smock, John C. Iron Mines and Iron-Ore Districts in the State of New York. New York State Museum of Natural History. Pp. 70, with Map.

Taylor, Thomas. M. D. Twelve Edible Mushrooms of the United States. Washington, D. C.: Gibson Brothers. Pp. 23, with Plate.

Toronto, City of. Report on Extension of Water-Supply and Disposal of Sewage. By Rudolf Hering and S. M. Gray. Pp. 26, with Maps, etc.

Turner, J. B. Extracts from Note-Books on "The Fallacies of Science and Faith," etc. Jacksonville, Ill.: Morton Brothers. Pp. 30.

Van Dalla, A. N., Editor. Pages choisés des Memoirs du Duc de Saint Simon. Boston: Ginn & Co. Pp. 237. 75 cents.

Wilber, Francis A. A Convenient Form of Gas-Receiver, etc. Pp. 3.

Wisconsin. Twelfth Annual Report of the State Board of Health. J. T. Reeve, M. D., Secretary, Madison. Pp. 302.

Woodward, C. M., St. Louis. Relation of Manual Training to Body and Mind. Pp. 26.

POPULAR MISCELLANY.

Practical and Moral Instruction in Schools.—What shall be taught in the schools, says the New York State Superintendent, in his last report, is a difficult question to answer. The law leaves it to each locality to settle for itself. "The tendency of the times, particularly in the larger places, is to undertake too much. It ought to be remembered that it does not devolve upon the public schools to put into the child's head all that he will ever be expected to know. . . . It is better to create a desire for knowledge, and supply the implements with which to gain it." The trial of manual training is commended, and this, it is observed, need not be confined to carpentry work with boys and making aprons and dresses with girls. Free-hand or industrial drawing may train the hand and the eye more effectually than handling a saw or a needle. Every school in the State may undertake this without difficulty. The importance of a pervading moral influence in the school-room is insisted upon. "There is, unfortunately," the superintendent remarks, "but little done to stimulate patriotism among children in the public schools, or outside of them. A generation ago it was common to use the masterpieces of our national oratory for the purposes of recitation and declamation in the schools, and the resultant influences were of no small consequence in arousing and cultivating patriotic ardor in the rising generations. Then every child was required to take part in the exercises. But even this is no longer common. The modern fashion is to take pupils who give promise of special success as orators and readers and train them elaborately for show upon public occasions. The older custom might be revived with profit." The normal schools continue to grow in size and extent and to improve in the character and quality of the work performed; and they are gradually confining themselves more and more closely to their legitimate work, the preparation of teachers for the public schools.

Methods of Transportation.—The development of the art of carrying is considered by Prof. O. T. Mason in a paper in the "American Anthropologist" on "The Beginnings of the Carrying Industry." Twenty distinct forms of the art are enumerated by him as preceding the modern inventions of transportation by the power of machinery. Among them are carrying in the hand, which is universal; with both hands, when the load is divided and balanced; on the fingers—the method of the ancient royal cup-bearers; with a baldric; with the load hung to a belt—chiefly employed in carrying treasure; hung to the arm, as when a basket is used; hung from the shoulders, on the shoulder, on the scapulæ, on the back, on the head, on the forehead or bregma, in pockets, by men combined, by hauling, by throwing or tossing, by caravans, with relays, and by couriers. Primitive commerce, says the author, "and all the

carrying and running involved in primeval arts connected with food, shelter, clothing, rest, enjoyment, and war, were accomplished on the heads or foreheads, shoulders or backs, or in the hands of men and women; and civilization, while it has invented many ways of burden-bearing, finds also an endless variety of uses for the old methods. . . . It is, for instance, only a few years since the invention of the passenger and freight elevator began to supplant that caravan of hod-carriers who have been since the beginning of architecture carrying upward to its completion every wooden and brick structure in the world. . . . The back is the natural resting-place for the burden. The lowest savages know this, and inventive genius early began to devise apparatus for harnessing this part of the body. In Africa, on the Andes, in Mexico, throughout the civilized world, the peaceable carrier bears on his back the commerce of the race."

Mexican Porters.—Mr. W. A. Croffut relates, in the "American Anthropologist," that of half a dozen porters whom he saw resting at a Mexican railway station—"One had a sofa on his shoulders, strapped on I could not see how; another bore a tower of chairs locked into each other and rising not less than eight feet above his head; another carried a hen-coop with a dozen or twenty hens, and others were conveying laden barrels and various household goods. They had come, they said, from San Luis Potosi, not less than fifty miles distant." The carriers were almost always in sight from the car-windows of the Mexican National Railroad, and were declared by President Purdy to be its rivals. If it were not for them, the country would treble its railroads in the next year, and the roads would double their profits. "We are combating the custom of centuries. Those fellows carry on their backs to Mexico the entire crops of great *haciendas* far over the mountains."

Monthly Distribution of Incendiary Fires.—Mr. Franklin Webster has found that the prevalence of incendiarism is susceptible of being graphically represented systematically according to the season. The monthly curves for the four years ending in 1886 show that there are more criminal fires in January than in February; that the number increases through March, April, and May, falls off in June, and then increases again till November, to fall off again in December. Taking the years separately, there appears to be an extraordinary regularity in the number of criminal fires in the first six months, while the chief irregularities and widest fluctuations are in the last half of the year; and in this period, criminal fires, taking the whole country, are excessive compared with the earlier months. In the farming districts they are more frequent when the greatest activity prevails, and are especially numerous in the time devoted to harvest; while, during the months when most of the great crops are growing, there is a lull in the reports of incendiarism. Mr. Webster concludes that incendiary fires for the sake of collecting insurance are rare as compared with other fires of criminal origin.

California's Thermal Springs.—According to a paper read by Prof. W. F. McNutt before the International Medical Congress, more than two hundred localities are known in California where waters of temperatures rising to 212° F., and charged with salts and gases of high therapeutic value, pour forth from the earth in great profusion. The number of individual springs in different localities ranges from one to thirty, each varying in composition, temperature, and possibly other as yet undetermined qualities. Although the character of these springs is known, only a few of them have, as yet, been carefully analyzed, and at still fewer have patients been under a competent observer's care. The seven *aguas calientes* springs at Warner's Ranch, fifty miles from San Diego, vary in temperature from 58° to 142°. An account is given of a wonderful little valley near Elsinore, containing altogether one hundred and eighty-six springs of hot and cold water, sulphur, soda, white sulphur, magnesia, iron, borax, hot mud, fresh water, etc. The Arrowhead hot springs, at an altitude of over two thousand feet, vary in temperature from 140° to 210°. An immense petroleum spring is mentioned as being some ten miles west of Santa Barbara, situated in the bed of the ocean, about a mile and a half from the shore, the product of which

continually rises to the surface of the water and floats upon it over an area of many miles. At the thermal acid springs in the Coso Range, Inyo County, thousands of tons of pure sulphur cover the ground, which were deposited there in former times, when the water must have contained large quantities of sulphureted hydrogen. Owens Lake is a remarkable body of water, which is more than twice as salt as the Atlantic Ocean. Volcanic mineral springs are lugubriously situated in Death Valley, and Saratoga Springs at the south end of Funeral Range, south of Death Valley. Mono Lake, in many of its features, resembles the Dead Sea. Of Byron Springs, in Contra Costa County, one, called "Surprise," is both cathartic and emetic. Some of the springs are sparkling with carbonic acid; others contain sulphureted and phosphurcted hydrogen; and there are hot mud-baths. Lassen County is full of hot (boiling) springs, having a temperature of from 200° to 212°.

Alpine Funerals.—A clew to the origin of the Irish wake and other funeral pomposities, which we are sometimes inclined to regard as relics of barbarism, may be found in the funeral customs of some of the Alpine regions. The circle of acquaintance of the more prosperous people of the villages often extends over miles of country; and the friends of a deceased proprietor will make long journeys to attend his funeral. The dictates of hospitality require that their physical wants be provided for; or, if not, they will meet at the inn and naturally have something very like a feast. In some districts, even before death occurs and the patient is in his last agonies, all around are informed of the fact and expected to make a ceremonial last visit. They enter the sick-room, take a long look at the dying man, and go their ways. After death, when the body has been prepared for burial, a table is spread covered with refreshments, and open house is held till the funeral. Whoever comes is invited to eat and drink. Two candles are kept burning by the coffin, and two women are employed to watch and pass their time in prayer. After the funeral a hot meal is given to the guests. In Carinthia, while perfect quiet and decency are preserved, the friends are invited to come in and say a prayer for the soul of their late friend, at stated hours, or during the whole time; and occasionally one of them repeats the prayer aloud, while the others join in. On leaving the room, each of the visitors is offered a piece of bread and a glass of wine or spirits, and is expected to accept. Such customs, perfectly simple and proper in their origin, may easily, when carried to excess or abused by unworthy persons or intruders, degenerate into the repulsive wake.

The Girl's Kitchen-Garden.—The Girl's Kitchen-Garden, a practical development of the Kindergarten in adaptation to English or American habits, is an institution for teaching girls from very childhood those things which pertain to good house-work and good housekeeping, by a series of illustrative lessons which are made as attractive as possible. It includes a graduated series of three courses. In the first course the girls are taught methodical daily work, by being taken step by step through the series of duties, to the accompaniment of lively songs, bright object-lessons, and little toy models for table-setting and bed-making. The second course includes washing, ironing, and house-cleaning; in the third course, the parts of beef and mutton, pie-making, baby-dressing with dolly, and "waiting on the door." An English journal observes, respecting the possible utility of the institution: "One can not but notice how happy little girls are if allowed to dust mother's chairs or to iron the stockings and handkerchiefs; how deftly they manage the sweeping-broom with a handle about twice as tall as themselves; how delighted to have a small piece of dough and make grimy little editions of mother's tarts. And one can not but be struck, too, by the fact that as these same little girls grow older they lose this taste, and come to look upon domestic work as drudgery, preferring, when they leave school, any occupation but house-work. Is not this, in a great measure, due to the fact that this natural womanly taste is neglected, and its cultivation left out of the girl's education, with the result that our girls go out as little maids-of-all-work with such profound ignorance and want of method that they are a torment to the mistress and a misery to themselves?" The kitchen-garden is intended to help remedy this evil.

Flirtation in Battak-Land.—The Battaks are a people of common origin with the Malays and resembling them in many respects, who live along the western coast and in the interior of the island of Sumatra. The district chiefs form a confederation, the strongest one among them residing near the Toba Lake. They have enjoyed the advantages of civilization, are good agriculturists, have an original system of writing, and take care to have their children instructed in such arts and knowledge as they appreciate; and yet they eat enemies who are taken armed, and criminals of a certain class, and adorn their tombs with obscene figures. As sentimental people in Western countries practice in a "language of flowers," so the young people of either sex among the Battaks correspond by means of a language of leaves. The leaves themselves have no significance, but their names, modified, perhaps, within the bounds of poetic license, indicate or rhyme with the word which the correspondent wishes to suggest. Besides leaves, corals, bells, ants, and the figures of all sorts of objects are employed for the same purpose. Dr. Van der Tunk, who has studied the Battak language, tells of another method of sentimental communication among them, by means of quatrains, which are called by them *endes* or *umpana*. In these the first two lines are suggested by the language of the leaves, which is employed to suggest their catch-word. They, however, have no particular significance, but lead up to the second pair of lines, in which is embodied the sentiment that the lover wishes to express. To be expert in the use of these *endes*, it is necessary to know a considerable number of them by heart. The young maidens are usually better versed in this lore than the young men, and there are often in the Battak villages some who make a business of supplying and interpreting them. It is one of the customs of the people that girls, as soon as they reach a marriageable age, shall leave the houses of their parents and go to live with some other unmarried woman (a widow or grass-widow). A strict surveillance is pretended to be kept over them, which is usually more honored in the relaxation than in the exact observance; and they are by no means debarred the society of young men during this period, nor ignorant of the art of flirtation. While occupied here in weaving mats and making tobacco-boxes and *sirih*-bags, they teach one another the *endes* which they have learned from their grandmothers and other old women, and for retaining which their memories possess enormous capacities.

Atmospheric Tides.—The question of the tides similar to ocean tides that may be created in the atmosphere by the moon has engaged the attention of many physicists since Newton. The longest series of studies on the subject is that of Eisenlohr, which includes thirty-two thousand observations distributed through twenty-three consecutive years. The author concluded that a certain equalization of atmospheric pressure is produced during a revolution of the moon around the earth. According to M. Maurice Guist, a later observer, the equalization is not brought about by the movement of masses of air, but by a kind of expansion of the atmosphere, which only sets in motion distinct particles of the whole mass. Since, in this way, the density of the air at any given point does not change much during a revolution of the moon, the temperature and hygrometric condition are no more influenced; neither the barometer nor other meteorological instruments, therefore, give proof of an atmospheric tide, although, in other points of view, the influence of the moon may be well marked by the instruments. The action of the sun must be still weaker than that of the moon. The equalization of pressure, in this view, takes place the more easily as the difference is less between the augmentation and diminution of density. These conditions exist when the regions of less and of greater density are near one another. Thus the equalization can take place at the quadratures rather than the syzygies; or when the sun and moon are 90° apart their influence is not cumulative as it is at the syzygies. This is fully confirmed by observations. Every culmination of the moon is preceded, for any meridian, by a barometric height inferior to the mean, and is followed by a superior height. The increase of pressure after the culmination is explained by the fact that the atmosphere, not being so much sustained by the moon, bears more heavily upon the mercury in the barometer, while the inverse phenomenon

occurs previous to the culmination. These two inverse variations of pressure may, however, be masked by meteorological conditions, as when there is an ascending or a descending current. During the winter months the mean pressure in the hours following the culmination of the moon is greater than in the hours preceding it. A current of rising air could mask the phenomenon, but there rarely is one at this season. During the summer months the variation is less marked. Finally, if we take account of the action of the sun, we shall find that these differences are more accentuated at the syzygies than at the quadratures, corresponding with what has been observed above. The results of observation thus prove that there really exists an atmospheric tide. It is hardly sensible to our instruments, because we are at the bottom of the ocean, subject to the action of the moon and the sun, and because the elastic force of the air is constantly tending to equalization of pressures.

Art and Fun of the Eskimos.—Much as has been written of the Eskimos, says Mr. E. F. Payne, in a paper read before the Canadian Institute, we find in almost every writing something new to interest us. Mr. Payne's own essay bears out the assertion. In building their *igloos* the Eskimos take advantage of the tendency of the snow to drift on the southeastern sides of the hills, so that the author, on visiting a village after a snow-storm, was struck with its resemblance to a lot of mole-hills. Nothing could be seen but a little snow thrown up on each side of a hole by which a passage led to the *igloo*; but, on a nearer approach, windows could be seen a little below the surface, from which the snow had been removed. Upon entering some of those *igloos*, passageways were found cut through the drifted snow, so connecting the huts as to give the appearance of an underground village. The people are not destitute of the art-sense, but have an inborn love of sketching, and are proficient in carving. Good models of *kyacks*, animals, and birds in ivory are made, especially on the north side of the strait, where the artists vie with one another in trying to make the smallest models. The art of drawing is confined for the most part to describing figures on the level surface of the snow, either with a piece of stick, or in larger figures with the feet. In several instances correct drawings of their own people were made by slowly moving along with the feet close together, and afterward dexterously adding details with one foot. Perspective was a great mystery to them; and even those who were accustomed to look daily at the pictures on the walls of the author's house could not understand it. Involuntarily their hands would steal up to the picture and feel for the objects that seemed to project; while other persons would shift their heads to look behind screens or doors in the picture. Amusements are few, and only one or two excite interest. Throwing the harpoon has the greatest attraction for the men, and wrestling and running are occasionally practiced till the weaker side loses interest. Foot-ball was played with the blown bladder of a walrus covered with leather. "Men, women, and children all took part in it, and no quarter was allowed. Here a woman, carrying her child on her back, might be seen running at full speed after the ball, and the next moment she might be lying at full length with her naked child floundering in the snow a few feet beyond her. A minute later the child would be again in its place, and nearly choking with laughter she would be seen elbowing her way after the ball again. Boys make small spears and throw them at marks; and girls have dolls and keep them till they are married, and they play at housekeeping and going a-visiting just like United States girls.

The Otter at Home.—The otter, as he may be seen sunning himself on a tree-trunk, looks like a large cat which has been thrown into the water and crawled out. Some people think that the fur of the otter throws the water off like the feathers on a duck's back. That is not the case; his fur protects his body in a different way. Any one who has seen a water-rat come up on a bank after a dive will have a good idea of the general appearance of the otter's fur. Now he gives his coat a shake and combs his fur a bit with his short, webbed feet. His head looks for the moment just like that of an infuriated tiger in miniature, as, with ears drawn close to his head, he snarls

and shows his teeth. When properly treated, the otter is easily converted into an affectionate and playful pet. He is a trifle larger than a cat, having a very similar head, only flatter, which is provided with a fine set of teeth, and he can use them with terrible force for his size. On his lip he has a lot of strong bristles. His eyes are small and have a watchful look about them; the neck is almost as thick as his chest; his body is long and round; the legs are very short, strong, and flexible; the toes webbed for a great part of their length, and the claws on them sharp. The tail is thick at the root, and tapers off to a point. It is very powerful, and is, in fact, his swimming-machine. In color he is dark brown, as a rule, with the sides of his head and throat brownish gray. On land the otter moves with a peculiar loping gait. When he comes up out of the water, there is first a little swell on the surface, then his head appears, and if everything is quiet he silently crawls up on a log or bank. When startled, he makes one gliding plunge, and the water closes over him with scarcely a ripple.

The Value of Human Variation. — Mr. Francis Galton, addressing the Anthropological Institute recently, said that anthropologists ought to give more consideration to variety than they have hitherto bestowed upon it. They commonly devote their inquiries to the mean values of different groups, while the variety of the individuals who constitute those groups is too often passed over with contented neglect. An average man is morally and intellectually a very uninteresting being. The class to which he belongs is bulky, and no doubt serves to keep social life in motion. It also affords, by its inertia, a regulator that, like the fly-wheel to the steam-engine, resists sudden and irregular changes. But the average man is of no direct help toward evolution, which appears to our dim vision to be the primary purpose, so to speak, of all living existence. Evolution is an unresting progression; the nature of the average individual is essentially unprogressive. His children tend to resemble him exactly, whereas the children of exceptional persons tend to regress toward mediocrity. The Hebrew race, whose average worth is not especially notable, is mainly of interest on account of its variability, which in ancient and modern times seems to have been extraordinarily great. It has been able to supply men, time after time, who have towered high above their fellows, and left enduring marks on the history of the world. In a mob of mediocrities, the general standard of thought and morals must be mediocre, and, what is worse, contentedly so. The lack of living men to afford lofty examples and to educate the virtue of reverence would leave an irremediable blank. All men would find themselves at nearly the same dead average level, each as meanly endowed as his neighbor. These remarks apply with obvious modifications to variety in the physical faculties. Peculiar gifts, moreover, afford an especial justification for division of labor, each man doing that which he can do best.

The Interdependence of Life.—The doctrine of the dependence of life on external conditions, says General R. Strachey, includes life itself as an important concurrent agency in the general results observed. Thus, in order to supply the food and other requirements of animals, the presence of vegetables or other animals is necessary. To some animals, as well as to some plants, the shelter of forests or particular forms of plants is essential. Parasites need for their sustenance living plants and animals. The fertilization and hence the propagation of plants is a development of life not deviating in any particular direction from that which follows the hereditary principle. It rather appears that the existing face of nature is the result of a succession of incidents, unimportant in themselves, which by some very slight alteration of local circumstances might have been turned in a different direction. For instance, a difference in the constitution or sequence of the substrata at some locality might have determined the elevation of mountains where a hollow filled by the sea was actually formed, or the converse, whereby the climatal and other conditions of a particular area would have been changed, and a different impulse there given to the development of life. All that we see or know to have existed upon the earth has been controlled to its most minute details by

the original constitution of the matter which was drawn together to form our planet. The character of all inorganic substances, as of all living creatures, is only consistent with the actual constitution and proportion of the various substances of which the earth is composed. Other proportions than those present in the constituents of the atmosphere would have required a different organization in all air-breathing animals, and probably in all plants. Any considerable difference in the quantity of water, either in the sea or distributed as vapor, must have involved corresponding changes in the constitution of living creatures.

The Medium of Electro-magnetic Action.—It was decided by experiment, during 1888, according to Prof. G. F. Fitzgerald, in the British Association, that electro-magnetic action takes place, not at a distance, but through an intervening medium. The experiments were made by Hertz in Germany, who observed the interference of electro-magnetic waves quite analogous to those of light, and proved that electro-magnetic actions are propagated in air with the velocity of light. "By a beautiful device Hertz has produced rapidly alternating currents of such frequency that their wave-length is only about two metres. I may pause for a minute to call your attention to what that means. If they vibrated three hundred thousand times a second, the waves would be each a kilometre long. This rate of vibration is much higher than the highest audible note, and yet the waves are much too long to be manageable. We want a vibration about a thousand times as fast again, with waves about a metre long. Hertz produced such vibrations, vibrating more than a hundred million times a second." While this rate is too slow for visibility or light, and the vibrations are also inaudible, the experimenter was able to detect them by resonance. He constructed a circuit whose period of vibration for electric currents was the same as that of his generating vibrator, and "was able to see sparks, due to the induced vibration, leaping across a small air-space in this resonant circuit." By this combination—of a vibrating generating circuit with a resonant receiving circuit—which the author had recommended at the Southport meeting of the Association to be used for this very investigation, Hertz was able to observe the interference between waves incident on a wall and the reflected waves. The phenomenon is the same as what are known as Lloyd's bands, in optics, which are due to the interference between a direct and a reflected wave. "It follows, hence, that just as Young's and Fresnel's researches on the interference of light prove the undulatory theory of optics, so Hertz's experiment proves the ethereal theory of electro-magnetism. It is a splendid result. Henceforth I hope no learner will fail to be impressed with the theory—hypothesis no longer—that electro-magnetic actions are due to a medium pervading all space, and that it is the same medium as the one by which light is conducted."

Washing Men and Children by Machinery.—One of the latest inventions in sanitation is machinery for personal washing. A French colonel, according to Mr. Edwin Chadwick, ascertained that he could wash his men with, tepid water for a centime, or one tenth of a penny a head, soap included. The man undresses, steps into a tray of water, and soaps himself, when a jet of tepid water is played upon him. He then dries and dresses himself in five minutes, against twenty minutes in the bath, and with five gallons of water against seventy in the usual bath. In Germany they have an arrangement under which half a million of soldiers are regularly washed. By an adaptation of apparatus to the use of schools, a child may be completely washed in three minutes.

Modern Deterioration of Eye-sight.—Dr. R. Brudenell Carter, when questioned about the causes of modern deterioration of eye-sight, replied that the circumstances of civilization are unfavorable to the cultivation of eye-sight. We are not as dependent on keenness of vision as our ancestors were. Much of the work of dwellers in towns is done upon objects close to them, from which they obtain large retinal images, whence they become comparatively insensible to small ones. They often work by defective light, and are thus driven to approach the object still more closely; and it is by such approximation that the malformation which produces short sight is mainly brought about. The increase

of the malformation is provided by itself: "structurally it is handed down to posterity, and mechanically it is increased by the practice which it compels of turning the eyes inward to combine upon a very near point." Among the consequences of short-sightedness are failure to develop the power of observation; blindness to the expression of the human face; an acuteness expending itself upon details with but a restricted power of grasping principles. The remedies proposed for the defect include testing of visual power and limitations of tasks to capabilities, and, in reading matter, large type with the upper part of the letters cut with particular clearness.

A Tame Gorilla.—An English trader at Ngove, on the southwest coast of Africa, Mr. J. J. Jones, has had for some time a young female gorilla whose docility is most remarkable. Jeannie, as the baby gorilla has been named, sleeps with her master, and follows him wherever he goes, weeping like a child if left behind. She recently accompanied him on a journey of twenty miles or more, walking all the way. She has acquired many civilized tastes and habits, and will drink tea, ale, brandy, etc., out of a cup or glass, displaying the utmost carefulness not to break the vessel. She will, in fact, do almost anything her master wishes, and is surprisingly intelligent and affectionate. This is by no means a solitary instance of the facility with which young gorillas can be tamed. The experience of others who have lived in the Fernand Vaz corroborates this statement as to their tractable disposition when treated with kindness, as well as the distress they exhibit if scolded for misconduct.

Proposed Storage of Nile Floods.—Mr. Cope Whitehouse presented before the British Association at Bath a plan, which he has been advocating for several years, for storing the surplus waters of the floods of the Nile in the depression called the Raian basin—which he believes to be the site of ancient Lake Moeris—to be drawn off again to irrigate the land of Egypt in the dry season. He computes that a reservoir capable of supplying low Nile with 50,000,000 cubic metres of water a day for 100 days can be made for £500,000. The canal of escape for the excess of the Nile flood, to be used as the canal of supply and discharge, can be opened in 300 days, by the excavation and handling of 8,000,000 cubic metres of sand, clay, and soft rock. The area and productive wealth of Egypt would be increased by more than one third. No burden would be imposed upon the present tax-payers. The works would be mainly the utilization and restoration of dikes, canals, and physical characteristics in actual use for the same purpose during 2,000 years, and, in part, in continuous operation from B. C. 1800 to the present time.

NOTES.

THE National Geographic Society has been organized at Washington "to increase and diffuse geographical knowledge," and will hold fortnightly meetings. It projects a physical atlas of the United States, and has begun the publication of the "National Geographical Magazine." It will give prominence to the educational aspect of geographical matters, and will endeavor to stimulate interest in original sources of information. It was organized in January, 1888, has about two hundred active members, and has formed itself into five sections: those of the geography of the land; of the sea; of the air; of the geographic distribution of life; and of abstract geographic art (map-making, etc.). Mr. Gardner G. Hubbard is president, and Mr. George Kennan Washington, corresponding secretary of the society.

THE British Government has yielded to popular clamor so far as to assent to a new and thorough investigation of the merits of vaccination. While assenting to this, it allows it to be given out that it sees no necessity, in any new facts that have been discovered, for such an investigation. It is suggested, in connection with a report that has been made to the effect that small-pox hospitals for isolation are a positive and deadly nuisance to those around them, that the question be also asked whether persons or communities have a right to concentrate a disease which they may easily avoid by congregating patients in such hospitals, to the serious risk of those who live outside.

PROF. EDWARD S. MORSE has been elected a corresponding member of the Society of Ethnology, Anthropology, and Archæology, of which Prof. Rudolf Virchow is president.

THE biography, papers, and letters of the late John Ericsson are to be edited by Colonel Church, of the "Army and Navy Journal." The Swedes have decided to erect a statue in Stockholm in honor of their distinguished countryman.

HYDROGRAPHER Dyer, of the Navy Department, reports that testimonials are constantly received of the efficiency and usefulness of the pilot charts and supplements. The record of floating vessels affords an excellent opportunity for studying the various phases of ocean currents. The supplement is issued whenever subjects of special interest demand it. Such supplements have been sent out descriptive of West Indian hurricanes and the law of storms; on the best transatlantic routes and the winter storm-belt of the Atlantic; and on water-spouts off the Atlantic coast. Reports of marine meteorology are received regularly from forty-six Government vessels and five hundred and forty-four of the mercantile marine. Many favorable reports have been received on the efficacy of oil in smoothing the waves.

A REMARK is made by Dr. A. G. Auld upon the strange fact that the effects of tobacco are so commonly overlooked in computing the causes of disease—for it is one of the most virulent poisons known, continually at work in the systems of those who use it, and a poison whose physical reactions have never been accurately determined. Dr. Auld is impressed that it is responsible for a variety of functional derangements which there is no reason to aver can not terminate in organic disease. Among these are albuminuria of which he has traced cases to the tobacco habit; and certain fibrillary twitchings, often excessive, that occur most frequently about the trunk and upper arms. When such symptoms are found in association with tobacco-smoking, it will not suffice merely to indulge less in the practice, but tobacco must be dispensed with entirely.

CONCERNING flamingoes straddling their nests, which Mr. Henry A. Blake has disputed ("Popular Science Monthly," March, 1888), Mr. E. J. Dunn, of Melbourne, has written in "Nature" that he has seen in Bushmanland numbers of the tall nests that are described and pictured in the books. They are conical, about eighteen inches high and six inches in diameter at the top, with a shallow, basin-like cavity for the eggs, were built in the water where it was a few inches deep, and could not have been sat upon unless they were straddled over.

THE London Diocesan Conference has suggested legal measures to meet the evil of too early marriages, and Dr. Matthews Duncan asserts that the age at which marriage takes place is one of the most important factors in the matter of defects of the reproductive function. He believes that fertility is surest and safest, and most happy in its results, at between twenty and twenty-five years in women, and twenty-five and thirty years in men; and regards the conditions as more precarious at an earlier than at a later age. The social and economical conditions are also not to be overlooked.

DR. BATTY TUKE insists upon the importance of giving more attention to efforts to cure insanity. This thought has been subordinated under the operation of the asylum system, which was begun for protection rather than cure, and of the theory of the psychological nature of insanity. The London County Council has now before it a proposition to appoint a committee to inquire concerning the expediency of complementing the existing system of treatment with a hospital and medical staff having a curative course in view.

A REMARK in the report of Principal Bliss, of the Detroit High School, on overwork, touches what is incontestably one of the weak points of the public schools. It should be remembered, he says, "that overwork is a continued rush. Our classes are large and our recitation periods short. The good of a class can not be sacrificed for that of an individual. In the hurry of our daily work, some boy or girl who is not strong enough to do our work may be overlooked. Have the public schools so far assumed the duties of parents that parents can be excused for not calling our attention to such a case?"

AFTER twelve years of experimental work at Rothamsted, Dr. Gilbert has found the old views confirmed respecting the value of a due apportionment of nitrogenous and mineral substance in the cultivation of potatoes. The present practices of good farmers with barn-yard manures are sustained, while mineral manures alone are of little effect. Although liberal manuring increases the tendency to disease, the effect is thought to be offset by the advantage of a heavy crop. The continuous growth of potatoes in the same land does not appear to render the crop more liable to disease, but rather the reverse. Thus, during three periods, of four years each, the percentage of disease in the various plots was reduced successively from 5·14–12·82 to 1·63–4·95, and 1·43–1·73.

A BIOLOGICAL survey of Kansas is in progress, under the direction of members of Washburn College, the eighth report of which is given in the Bulletin of the Laboratory of Natural History. It includes a fourth series of notes on fishes, by Dr. C. H. Gilbert, and Mr. B. B. Smyth's catalogue of flowering plants and ferns, in which 1,602 species and varieties are named.

POROUS rebaked porcelain has been found by Dr. C. G. Currier to be the best substance for domestic filters. If thick and strong enough to allow the use of a large surface, and the substance remains perfect, it may yield a fair flow of clear water, free from all bacteria; yet under the ordinary Croton pressure, the yield is only in rapid drops, unless the apparatus be complex. The filter should be occasionally sterilized throughout, by steaming or other means.

Dr. Ogle, an English statistician, while admitting to the full extent alleged the movement, in England and the United States, toward the towns and cities, denies that it is attended by a depopulation of the rural districts. He has found that the rural population in England did not decrease between 1851 and 1881 by more than one per cent, a rate quite within the limit of allowance for error. The author believes that the rural population is only stationary, and is ample, with the modern improvements in farming, for the tillage of the land, while only its increase and surplus pour into the towns; but the continuous migration of the most vigorous and energetic to the manufacturing districts, and the higher mortality there, may be producing a gradual deterioration.

While asserting that attention has hitherto been largely paid to the preservation of the unfit members of society by not allowing them to disappear according to natural causes, and thus propagating unfitness, Dr. Thomas Searcy, of Tuscaloosa, Ala., suggests that a higher field of effort lies in the direction of increasing the proportionate numbers in society of the more fit. Apparently, in modern society, the object of effort is to reach such a degree of competency that one's children will not have to strive. Degeneracy then sets in. The first generation may succeed by force of the brain-power transmitted from its parents, but the after-generations have no bottom to stand upon.

In a recent lecture on the education of girls, Mr. James Oliphant condemned the impression that the education of the two sexes should be governed by the same rule. Physical deterioration, he said, could best be prevented by a suitable distribution of studies during the day, and by allowing hourly short interludes of muscular exercise. There was, in our modern plan of study, too much reiteration and too little thought, a consequent sense of drudgery, and a lack of the interest which comes of using the reasoning power. Home lesson work had become a sort of tyranny. The possession of special aptitudes did not justify the preference often given to them in cultivation, at the expense of less developed faculties.

In the lack of any national registry of vital statistics, the Superintendent of the Census of 1890 will rely upon the physicians to furnish an approximate estimate of the birth and death rates of most of the country. He is accordingly issuing to the medical profession "Physicians' Registers," with blanks, which they are invited to fill, and thus furnish more accurate returns than it is possible for the enumerators to make. In order that the returns of farm products and live stock may be as full and complete as possible, farmers are requested to keep accounts of such matters from June 1, 1889, to May 31, 1890.

The demand for its leather, which is so pleasant for summer shoes, has brought the kangaroo into imminent danger of extinction; and the Australians are contemplating measures for restricting the slaughter of the animal.

Dr. Koch's theories respecting the functions and work of the cholera bacillus, which have been disputed, and even discredited by certain commissions, have now been confirmed in their most important points by the researches of Drs. Neil Macleod and Milles. These gentlemen, who practice in a part of the British Empire where cholera is endemic, have identified, isolated, and cultivated Koch's spirillum, and confirm his original statement as to its pathogenic character.

Out of more than five hundred letters received by the Principal of the Detroit High School in answer to questions concerning the effect of the studies on the health of the children, 87·81 per cent sustain the work of the school. The sixty-two complaints are of various character, and refer among other things to "hard-studies," bad air, long lessons, and worry. In fourteen of the cases of complaint the pupils were doing more than the regular work; and requests to be allowed to do this had in some instances followed complaints.

According to Dr. Ozeretskofski, hysteria exists among Russian soldiers, and presents as various diversities of form as it does among women.

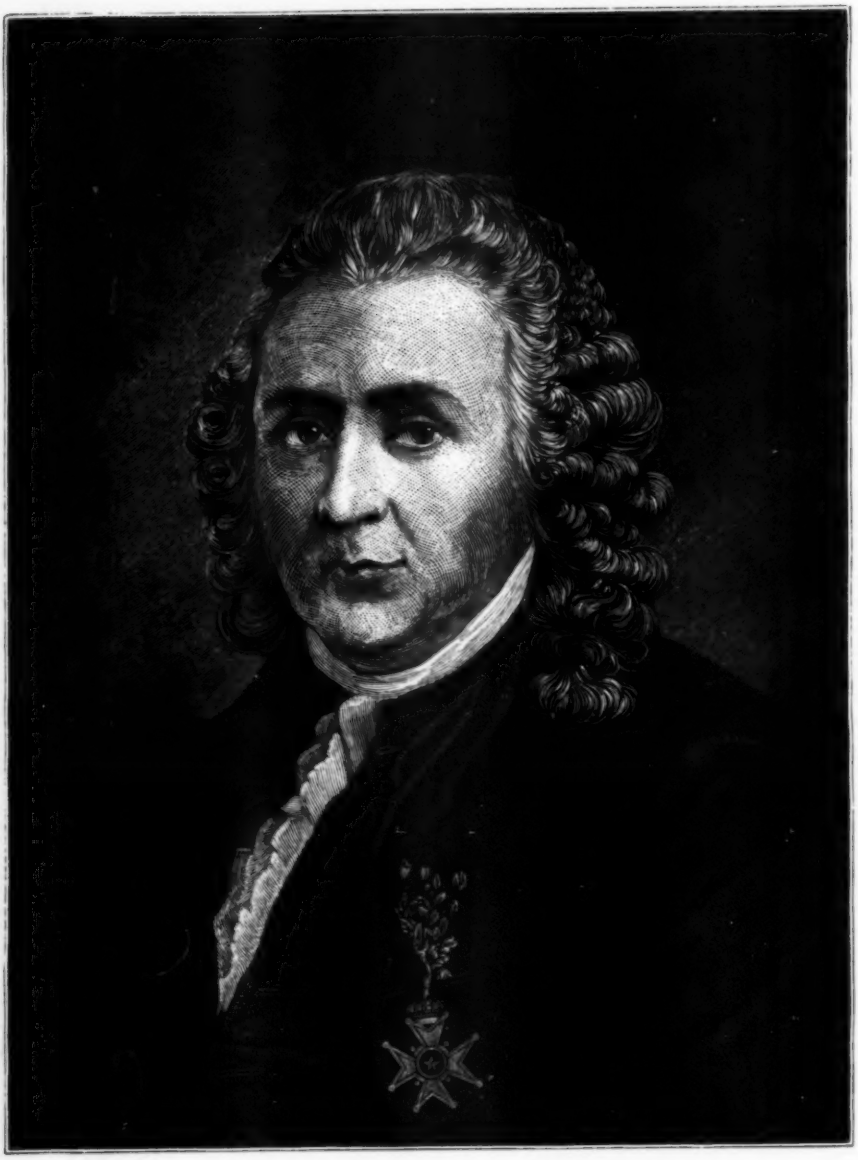
OBITUARY NOTES.

Eugen Ferdinand von Hameyer, an eminent ornithologist, and President of the Ornithological Society of Berlin, died in Stolp, Prussia, June 1st, at eighty years of age. He was the author of several books, and possessed the largest existing collection of European birds.

Mr. John F. La Trobe Bateman, the engineer who supplied Glasgow with water from Loch Katrine, died June 10th, aged seventy-nine years.

Heinrich Gustav Reichenbach, Professor of Botany and Director of the Botanic Garden at Hamburg, died there, May 6th, in the sixty-seventh year of his age. He was born in Leipsic, the son of a botanist and professor at Dresden, and co-operated with his father in the preparation of the later volumes of the "Icones Floræ Germanicæ et Helveticæ." He devoted more than forty years of his life chiefly to the study of orchids, in knowledge of which he was the first.

Charles Harvey Bollman, museum assistant in the University of Indiana, a young naturalist of great promise, died July 13th, at Waycross, Georgia. He was in charge of the explorations of the United States Fish Commission in Georgia.



CAROLUS LINNÆUS.